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CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America.

By John C. Trautwine, Civ. Eng., Philad.

To the Committee on Publications.

Gentlemen—I avail myself of your Journal, to communicate a few leading facts respecting the proposed Inter-oceanic Canal Route, by way of the Rivers Atrato and San Juan, in New Granada. They were elicited during a hasty exploration of that route, made by myself, in the year 1852, under the auspices of a few enterprising gentlemen in the city of New York, represented by Messrs. Belknap and James.

Desirous to test the feasibility of the project, in a commercial point of view, these gentlemen contributed the necessary funds, on a liberal scale; and desired me to undertake the task.

The purely financial motives which dictated the survey; combined with the necessity for expediting it as much as possible, preventing me from devoting any attention whatever to objects of scientific inquiry not having immediate reference to the principal question. This was, the availability of the route for steamers of about six feet draft, from ocean to ocean.

Further than this, I was left unimpeded by instructions; and at liberty to adopt such a course of proceeding as I might deem most expedient.

Since my return, professional engagements have prevented me from drawing up such an account of my observations as I should wish to make public; and my only apology for now presenting the following

crude and immethodical statement of some of the more prominent features of the route, is the hope that I may thereby obviate the necessity of replying to the numerous communications on the subject which I am constantly receiving from persons who have incidentally become apprized of my trip.

It would afford me sincere pleasure to prepare a full and detailed narrative of my operations, embracing the numerous objects of interest that presented themselves during the exploration; but more imperative duties prevent my doing so at present.

I at first determined to take with me but one person, Mr. Henry McCann, to act in the capacity of purveyor; that my own time and attention might be exclusively devoted to the more important objects of my mission. Subsequently, however, I added Dr. Mina B. Halsted, a young physician of New York, possessed of scientific attainments beyond the mere requirements of his profession. Impelled by a desire to investigate the botanical treasures of the valley of the Atrato, the Doctor expressed a wish to accompany me, if but as an amateur traveler, defraying his own expenses. To the first part of his proposition I assented; but could not accede to the last.

He assisted me very efficiently in many of my operations. His botanical researches were, necessarily, imperfect, as I did not feel at liberty to prolong the exploration for considerations of secondary importance, however interesting they might be in themselves. His results would have been incorporated in a full narrative of the expedition, had I had leisure to prepare one; but, as such is not the case, I hope they may be made known through some other medium.

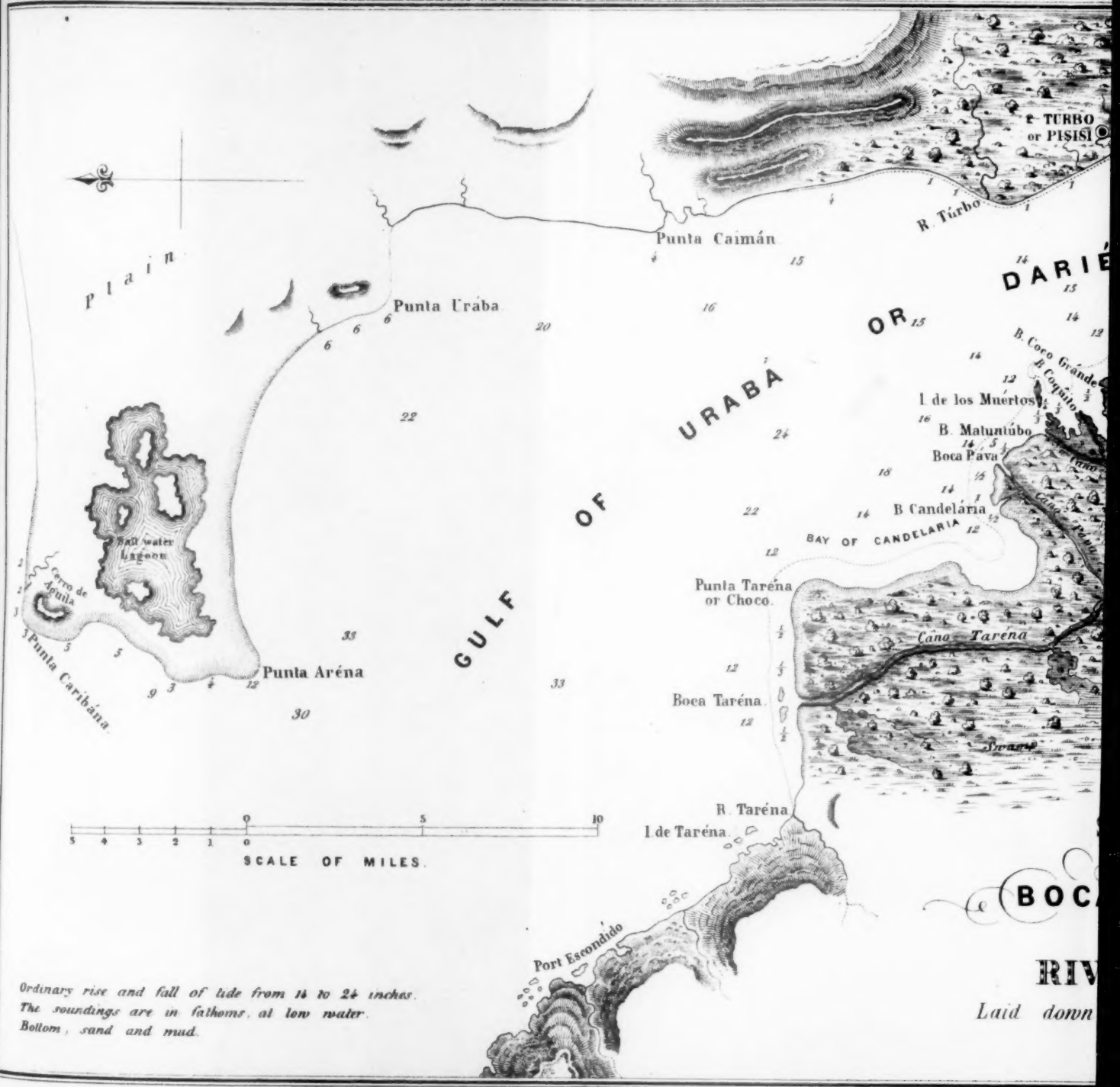
Passing over further preliminaries, we will at once commence with the mouths of the River Atrato. The accompanying map, Plate I., of these mouths, which is prepared from my own observations, differs materially in many points from the best Spanish authorities that I could obtain. I presume, however, that the discrepancies are more justly ascribable to actual changes, which have taken place in the interval that has elapsed between the two sets of observations, than to error on the part of the observers. This supposition is rendered the more probable from the fact that I found the map to be comparatively correct from the mouths to the very head of the river, a distance of nearly three hundred miles.

I will premise, that my estimate of distances, along the streams, was based upon frequently repeated observations of the rate at which our boat was poled along; and that, consequently, although not strictly correct, they may, at least, be assumed as very tolerable approximations to the truth. Allowing the utmost latitude for error, I am confident that they are generally within ten per cent. of the actual distances.

The several branches by which the river discharges itself into the Gulf of Urabá or Darien, are called caños, pronounced cán-yös. The mouths themselves, or points at which these caños enter the gulf, are called bó-cas, (Spanish for mouths.)

It will be seen from the map, that all the mouths of the Atrato (nine in number) have their courses through an extensive region of swamp.

At the immediate banks of the streams, the swamps are elevated a few inches above the water-surface, in its ordinary stages; but at the distance


TURBO
or PISISI
R Túrbo
Punta Caimán
plain
Punta Urába
GULF OF URABA OR DARIÉ
B. Coco Grande
R. Coquito
I. de los Muertos
B. Matuntúbo
Boca Pava
B Candelária
BAY OF CANDELARIA
Punta Taréna
or Choco.
Cano Taréna
Boca Taréna
Swamp
R. Taréna
I. de Taréna
Port Escondido
Salt water
Lagoon
Cerro de
Aguila
Punta Caribána
Punta Aréna
SCALE OF MILES.
Ordinary rise and fall of tide from 14 to 24 inches.
The soundings are in fathoms, at low water.
Bottom, sand and mud.
Laid down

SKETCH

OF THE

BOCAS OR MOUTHS

OF THE

RIVER ATRATO.

Laid down from observations made by

JOHN. C. TRAUTWINE

le by
BAUTWINE, Civ. Eng.

Lith. of P.S. Duval & Co. Philad.a

of a few rods back, they are about level with it; consequently, when the caños are swelled a foot or two, by either a rise of the river above, or by the action of the North winds in forcing the salt water of the gulf inland, this broad expanse of marsh becomes inundated; presenting the appearance of an immense lake, studded with trees.

The soil is composed of a black mud, and very fine sand, which supports a vegetation of undergrowth and trees; generally dense near the water's edge, but more sparse at some distance back from it. I observed that none of the trees attained more than a very moderate size. This is, probably, attributable, in part, to the effect of the salt and fresh water, in which their roots are alternately submerged; for, above the point to which the salt water of the gulf is sometimes driven, the trees are larger. Still, I do not remember to have seen a single really large tree growing throughout the entire course of the Atrato.

The North winds sometimes back the salt water of the Gulf of Urabá more than twenty miles up the river, or to some distance above its confluence with caño Urabá.

It is evident that the attempt to locate a town, or settlement of any kind, throughout this extent (or, as will be seen hereafter, for a great distance above it,) would be attended with excessive labor and expense. Buildings would necessarily have to be elevated several feet above the surface of the soft marsh; the construction of streets and roads would be extremely difficult; and, together with the maintenance of a supply of fresh water, could be effected only by the expenditure of very large sums.

The formation of these immense swamps has been the result of depositions of mud, sand, trees, &c., which, for ages, have been accumulating and encroaching upon the waters of the Gulf of Urabá. These depositions are brought down from the upper country by the river itself, in times of flood; and the process is still in active operation. It is quite apparent that the entire bed of the river, from near its very source, has been formed in this manner; as it is confined throughout, between natural levees, backed by wide tracts of swamp land, considerably lower than the tops of the levees; and annually overflowed by the floods of the river, which overtop the levees themselves to a height of some few feet.

The current through the Bocas, being checked on encountering the waters of the gulf, allows the mud and sand to subside, and thus form bars outside. Upon these bars floating trees and logs are lodged and retained, and by constant accumulation soon reach the surface, when vegetation commences and progresses with great rapidity.

By this process the mouths gradually advance themselves out into the gulf, through banks of their own creation. The accompanying sketch, Plate II., of the entrance into Boca Coquito will convey a tolerable idea of this operation of nature.

Bars of sand and mud encircle all that part of the gulf coast within which the mouths of the river are comprised; and may be regarded as extending some way up into the caños themselves, because the latter deepen considerably as we advance a short distance (rarely exceeding a few hundred yards) above their actual mouths, or points of effluence into the gulf.

These bars, especially in front of the Bocas most exposed to the

North, are subject to great and sudden changes, depending on the alternate ascendancy of one or the other of two antagonistic forces which are constantly acting upon them. From December to March, (both inclusive,) during which interval the North and North-east winds from seaward prevail, and at such times as the river is not much swelled by heavy rains in the interior, the bars with a Northern exposure accumulate rapidly, *by the heaping up of sand from the gulf*, until they become nearly dry.

Those mouths which are comparatively sheltered from the effects of the Northers, and from the swell of the sea, are of course less liable to the heaping up of bars of sand from the gulf; and, consequently, their obstructions, although consisting of softer material, (mud and fine sand, brought down *by the river*, instead of the course sand *of the gulf* bottom,) maintain a somewhat more permanent regimen; and would, consequently, be more readily susceptible of artificial improvement.

When the more exposed mouths become thus obstructed, they preclude, for a time, the entrance of vessels drawing more than about three feet; and even that limited depth is frequently confined within a very restricted channel width, and obtainable only at high water.

But when, on the other hand, the river, in a high stage, is discharging a great volume of water through the Bocas; and when, at the same time, the seaward winds are comparatively quiet, (or succeeded by the milder Southers and irregular winds, which blow gently from April to November,) the action of the streams partially wears down the bars, and transports back again the sand of which they were composed to a considerable distance out into the gulf.

At such times, channels of some hundreds of feet in width, and from one to two fathoms in depth, are opened across the bars, affording free ingress to vessels of moderate draft. When I visited Boca Tarena, about the middle of June, the sand-bar in front of it was *entirely dry* in many places, at a distance of a mile out into the gulf. This mouth is more exposed than any of the others, to the bar-forming agency of the Northers.

At Bocas Candelária and Páva, I found but two feet of water at one-fourth of a mile from shore; and opposite Boca Matuntúbo, through which Caño Barbacoas discharges itself into the gulf, there were but three feet for a width of one-fourth of a mile, parallel to the shore; and distant from it, from a half to three-quarters of a mile.

In all these cases, however, the depth increases rapidly on the seaward side, after crossing the bars. The little steamer *Esmeralda*, bound up the Atrato, on a gold-hunting expedition, crossed the bar of Matuntúbo a few months after I examined it; and I was informed that she found a channel depth of nine feet where I had found but three.

And several years ago, a British steamer, with diving machinery for under-water gold explorations, and drawing (I was credibly informed) eight feet, crossed the bars without any trouble, and ascended the river for about 250 miles. The boat in which I ascended, and which is one of the largest that trade between Carthagena and Quibdó, drew but three and a half feet; and grounded at the mouth of Caño Coqúito; so that we were compelled to wait for high water before we could enter.

TUREO OR PISU.

I had no opportunity for ascertaining the existence of oceanic currents along this part of the coast; and, consequently, can advance no opinion as to what extent the alternate formation and destruction of these bars may be effected by their agency. I know, however, that if such currents do exist, their velocity is very slight; and can perform but a secondary part in the process which interposes so formidable a barrier to the navigation of the noble Atrato.

Thus, it is evident, that *in the present condition of these bars*, no scheme of navigation by steamers, or vessels of greater draft than the river boats now in use, could be carried into effect, in case *regularity* of transit constituted an essential element of success to the project.

I have arranged, in the following table, the soundings across the several bars, immediately in front of the Bocas, as I found them in June, 1852; commencing with the most Northerly one; or Tarena, and taking the others in regular succession:—

Soundings in feet at low water.

Names of Mouths.	A short distance inside of the mouth.	In the mouth.	One hundred yards out.	Two hundred yards out.	Three hundred yds. out.	One-fourth of a mile out.	Half of a mile out.	Three-fourths of a mile out.	One mile out.	One and one-fourth of a mile out.
Taréna, . .	25	16	13	12	12	10	7	6	2	70
Candelária, .	12	8	3	3	3	4	70	—	—	—
Páva, . .	18	8	3	3	3	4	21	70	—	—
Matuntúbo, .	18	13	10	8	9	6	3	3	18	70
Coqúito, . .	12	9	2	2	2	4	6	10	72	—
Coco Grandé, .	22	12	3	3	3	4	32	—	—	—
Pantano, . .	18	11	About the same as opposite Coco Grandé.							
Urabá, . .	22	12								
Piquindé, . .	—	—								

Bocas Taréna and Matuntúbo discharge much greater volumes of water than any of the others; consequently, the balance of power between their streams, and the waters of the gulf, takes place at greater distances from the shore; making the most dangerous parts of their bars at about a mile outside of their entrance into the sea.

Any attempt to improve either of these mouths, (or that of Páva, or Candelaria,) so as to be, at all times, available for vessels of but six feet draft, would not only be attended with great expense; but would, in my opinion, involve the utmost hazard of failure. I have no hesitation in admitting that I am unacquainted with any scheme that can be confidently recommended for the permanent accomplishment of that purpose; and shall, therefore, not occupy time in discussing the various expedients that might be supposed applicable. All attempts of the kind, under similar circumstances, have proved signal failures; and the resources of engineering science afford no aid in cases of such magnitude as would be involved in this instance.

The other, and smaller mouths lying further inside the Gulf of Urabá, are also subject, though in a less degree, to the same class of impedi-

ments. The one which I regard as most susceptible of improvement of a somewhat permanent character, at a moderate expense, and on a small scale, (say, for instance, one that would secure a depth sufficient for vessels of six or eight feet draft,) is that of Coqúito.

In its present condition, this mouth and its accompanying caño are the most insignificant of them all, except Pántano, and Piquindé. It will be seen, in Plate I., however, that the mouth is partially sheltered from the disturbing effects of North and North-east winds, by the Isla de los Muértos, or Island of the Dead.

This island is about three-fourths of a mile in length; low and flat. It has evidently been formed by the accumulation of mud and vegetable matter deposited by the adjacent caños; and will probably soon be united with the shore by the same process, as the depth of the intermediate water does not now average two feet at low tide. The low water depth opposite caño Coqúito, and close to it, is scarcely two feet; but gradually increases to six feet, at the distance of half a mile out into the gulf. In a quarter of a mile more, the depth becomes ten feet, and immediately afterwards forty feet; increasing to seventy feet at a distance of a mile from shore.

The bottom consists of mud and very fine sand; so soft that a pointed pole can readily be pushed into it for six or eight feet. I suspect, that by confining the channel from the mouth outwards, (to such a distance as would reach the required depth of water,) so as to prevent its spreading over a wide surface as it issues from the caño, the force of the ordinary gentle current, aided by the more rapid ones of flood stages of the river, would, of itself, deepen a channel sufficient to allow, at all times, the passage of such boats as could regularly ascend the Atrato to Quibdó, a distance of about 220 miles.

At all events, this could readily be effected by the aid of a dredging machine.

As to the mode of confining the channel, I would follow the example set by nature herself, in constructing similar works at the same spot: encouraging the deposit of sediment for the banks by placing two rows of poles, water-soaked logs, branches, &c., to form the nucleus for receiving and retaining it. The process should be expedited by throwing upon these, some of the mud of the intermediate space. This deposit would immediately become covered with vegetation, by which its durability would be secured. It is by a process precisely analogous to this, that the river has, and still is, rapidly extending the banks of its various caños into the gulf. From the fact that the depth increases so immediately, from six, to forty feet, and from that to seventy feet, I conceive that a long time would elapse before the accumulation of sediment at the outer extremity of this artificial channel would be productive of inconvenience.

A similar method might, I think, be successfully employed at Boca Urabá; but, for the reason before expressed, I should prefer Coqúito. The latter is the passage almost invariably selected by the river boats.

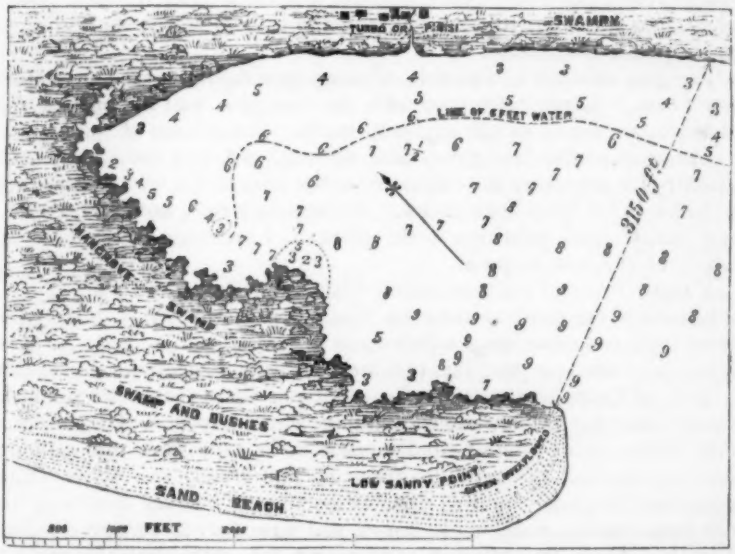
I nowhere found the currents through the caños to equal a mile per hour; and doubt whether, even in floods, they reach two miles per hour; in consequence of the facility which the lowness of the adjacent region affords for the spreading of their waters.

The Atrato, when in flood, throws a current entirely across the gulf, to its Eastern shore. I frequently drank the water dipped up opposite some of the larger mouths, at the distance of a full quarter of a mile from them, without perceiving the slightest saline taste.

The Bay of Candelária is referred to in books of navigation, as affording a safe harbor; but I confess myself at a loss to perceive upon what principle it can be assumed to do so, except that of the rare occurrence of violent Northerly winds, that should endanger the safety of craft anchored in it.

That such winds occur in that region only at rare intervals, is unquestionably true; and this fact constitutes a redeeming feature in more harbors than one, on this, and the adjacent coasts, that would otherwise be highly objectionable. I may cite, for instance, that of Navy Bay, at the Atlantic terminus of the Panama Railroad, which relies entirely upon this hazardous dependance for its character as a place of refuge. I regard the lower, or more Southerly portion of the gulf, as altogether preferable to the Bay of Candelaria, in the event of actual stress of weather.

HARBOR OF TURBO OR PISISI.



Rise and fall of tide about 18 inches. Soundings in feet, at low water. Bottom, mud and fine sand.

The town of Túrbo, Plate III., on the Eastern shore of the gulf, opposite Boca Coqúito, is merely a collection of about a dozen huts. There is no other town in the vicinity of the gulf. Having, while in Carthagena, heard some importance attached to the Harbor of Túrbo, I had hoped to find it, at least, an efficient shelter for coasters, and such steamers as it might be thought advisable to place on the Atrato. Upon making a survey of it, however, I found that its merits had been entirely overrated, as will be apparent upon referring to the annexed cut. It is gradually shoaling, by the inwashing of land mud by rains; and I was told that a marked deterioration has been from time to time observed.

The larger published maps of the Gulf of Urabá would lead to the supposition that some rivers of considerable magnitude enter it along its Eastern and North-eastern coasts. Such, however, is not the case. The streams laid down as rivers, are merely extensive *washes*, penetrating some miles into the interior, and serving as drains during the rainy season. In dry periods, most of them become nearly destitute of water; and many of them entirely so; and their mouths are then completely closed by the heaping up of sand from the bottom of the gulf by the action of the Northers. I was informed that the River Túrbo was by far the most constant and important of them all; and even it, is but an insignificant stream, barely adapted to small canoes, when its mouth is not closed by sand. Were Túrbo itself a place of any magnitude, its probable dependence for water would be from this river; but at present, the limited demand is met by a scanty and precarious supply obtained from the immediate vicinity of the town, (if such it may be called.)

I had not time to visit the mouth of the River Guácuba, or Lion, at the Southern extremity of the gulf; but was informed, in vague terms, by persons in Túrbo, who had repeatedly ascended it in canoes, that it was a large river; extending a great distance into the interior, where it branched out into numerous tributaries, extending to gold regions near the Eastern slope the Cordilleras.

The gulf abounds in fine fish, of many species, and large size, entirely new to me. Large turtles, of both the common, and the tortoise shell varieties, are found on the adjacent coasts. Sharks also abound.

The india rubber tree grows here, although not very abundantly; and a factory for preparing the rubber from the milk of the tree is established at Túrbo, by a New York house. Its appointments, however, are on a very limited and primitive scale, adapted, I presume, to the moderate supply of the raw material.

A small tribe of Indians, called Caimánes, (alligators,) are the sole occupants of the territory between Túrbo and Punto Aréna. They construct their rude dwellings a little back from the gulf, so as to be out of sight. For what purpose this is done, I could not ascertain. Some three or four of their men came on board of our little vessel, as we lay at anchor near the shore, after rounding Punto Aréna. They were of short stature, good natured, and inoffensive in appearance and conduct; and fully sensible of the merits of segars, and brandy and water. They wore their long hair confined close to their heads by rude combs of their own manufacture; made of fish bones, tied separately to a transverse piece of stick. Their dress, though very coarse, was scrupulously clean, and consisted of shirt, trousers and roundabout. Unlike the other Indians with whom we afterwards met; they did not speak Spanish, so that our conversation was conducted on the pantomimic principle.

About the Gulf of Uraba, rains fall chiefly during the eight months from April to November, both inclusive. They are not, however, by any means excessive, even during this period; but occur chiefly in the shape of short smart showers, of from a few minutes, to some hours duration, especially during the night; with occasional heavy and prolonged falls of one or two days. It is even by no means uncommon for intervals of from three to six days to elapse, during this wet season, without

J. C. T. del.

ENTRANCE TO CAÑO COQUITO.

P. S. Duval & C.ᵉ steam lith. press. Phil.

a drop of rain. Of the ten days of June (from the 5th to the 14th) that I remained at the gulf, it rained, more or less, on seven. With the exception, however, of a single heavy fall for four hours one afternoon, the rains that occurred during *the day* were commonly mere trifling sprinklings, that did not interfere with my surveying operations; but, on three of the *nights*, the rains were copious and of some hours duration; accompanied by a good deal of thunder and lightning. Subsequent experience of some months, along the vallies of the Atrato and San Juan, proved that by far the greater portion of the rain of that region falls during the night.

The following table presents the readings of my aneroid barometer, which was suspended in the shade, in the doorway to our little cabin, (or, rather, oven,) at the height of three feet above the level of the sea:—

Time of day.	JUNE.									
	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.
A.M.										
4½	. .	. .	. .	. .	. .	. .	. .	29·895	. .	. .
5	. .	. .	29·912	. .	. .	. .	. .	. .	. .	. .
½	. .	. .	. .	. .	. .	. .	29·892	. .	. .	. .
6	. .	29·948	. .	. .	29·925	29·920	·895	·920	29·940	29·910
½	. .	. .	. .	29·930	. .	. .	. .	. .	. .	. .
7	29·975	. .	·948	·950	·950	·925	·897	·925	·950	·925
½	. .	·985	. .	. .	. .	. .	. .	. .	. .	. .
8	·987	30·010	. .	. .	·951	. .	·925	·940	·975	·940
½	. .	. .	. .	. .	. .	. .	·930	. .	. .	. .
9	30·012	. .	30·000	·973	. .	·945	·945	·965	·980	·962
10	30·018	30·025	30·000	·965	·972	. .	. .	·940	·978	·975
11	. .	30·000	. .	. .	. .	. .	·930	. .	·960	·970
12	30·000	29·980	29·950	·950	·920	. .	·925	. .	·950	·970
P.M.										
1	29·992	. .	. .	. .	·895	. .	·900	. .	·940	·930
2	. .	.950	. .	. .	·900	. .	·875	·925	·925	·900
½	·940	. .	. .	. .	. .	. .	. .	. .	. .	. .
3	. .	·912	29·876	. .	·850	. .	·860	·900	·900	. .
½	. .	. .	. .	. .	. .	. .	. .	. .	. .	·860
4	·935	·908	·872	. .	·875	. .	·860	·915	·880	·860
½	. .	. .	. .	. .	. .	·895	. .	. .	. .	. .
5	·925	. .	. .	. .	·868	. .	·875	·920	. .	·850
½	. .	. .	. .	. .	. .	·850	. .	. .	·880	. .
6	·937	.925	. .	·890	·895	·850	·900	·925	. .	·850
7	·945	. .	·900	·900	.895	. .	. .	·920	·875	. .
½	. .	. .	. .	. .	. .	·875	·890	. .	. .	·850
8	·942	. .	·915	. .	·925	·878	. .	·925	·880	. .
9	. .	. .	·927	. .	·975	·875	. .	·930	·925	·870
½	·962	. .	. .	. .	. .	. .	·900	. .	. .	. .
10	. .	. .	. .	. .	. .	. .	. .	. .	. .	·895
½	. .	. .	. .	. .	. .	. .	. .	. .	. .	·900

The thermometer, in the same position, generally ranged between 80° and 82° of Fah., at sunrise; 85° and 93° at noon; 86° and 95° at 3, P.M.; 84° and 90° at sunset.

The Veranillo de San Juan, or short summer of St. John, is a comparatively prolonged spell of dry weather, that annually interrupts this

rainy season of eight months. It generally commences in August, and extends through the greater part of that month. Its periods, however, are subject to a considerable irregularity, as it sometimes begins in July; and sometimes, though rarely, even in June, and is prolonged through July into August. In other years, again, its entire duration is limited to but two or three weeks.

During my stay, the winds were light, and blew alternately from every point of the compass; affording no indications of either regularity of recurrence; or of a prevailing direction. The only birds I saw about the gulf, were two or three spoonbills, and a few cranes. Along the beach, near the mouth of Barbacoas, we picked up some small fragments of gum animé.

In my next communication, I will refer to the caños, and to the River Atrato itself; together with the lower portions of the Napipi, and one or two other tributaries which I ascended, and sounded, for a few miles.

(To be continued.)

Report of the Board of Managers of the Mine Hill and Schuylkill Haven Railroad Company, at their Annual Meeting, January 9, 1854.

The Board of Managers have the pleasure to lay before the Stockholders of the Mine Hill and Schuylkill Haven Rail Road Company, their Twenty-Fifth Annual Report.

In amount of coal transportation, the business of the road for the year just closed has not quite equalled the expectations of the Board at its commencement, having fallen below that of the previous year about eight-tenths of one per cent.

Similar retrocessions of much greater proportional magnitude have occurred several times in the brief history of the anthracite trade. For example, the business of the road in the year 1834, was forty-four per cent. less than in 1833; also in 1838 it fell off sixteen per cent., and in 1842, fourteen per cent. from the business of the year preceding.

From 1842, it steadily increased at an average rate of about 70,000 tons a year until 1848, when a temporary pause ensued for almost two years, in which the average growth was only 20,000 tons. In the next succeeding biennial term, the advance was beyond all precedent, reaching almost 200,000 tons each year, or nearly sixty-six per cent. increase in the space of two years, and presenting an example of one of those great waves of progress which, in accordance with the common law of growth, whether in nature or in trade, must be followed by a temporary reaction.

By the weekly returns from the Collector's books, the gross tonnage of coal is shown to be one million forty-nine thousand four hundred and sixty-one (1,049,461) tons, and the amount of other merchandise, nineteen thousand seven hundred and forty-five tons, two cwt. ($19{,}745\frac{2}{20}$). Making together, after deducing five per cent. allowed to the dealers for wastage, an aggregate net tonnage of one million sixteen thousand seven hundred and thirty-three tons, one cwt. ($1{,}016{,}733\frac{1}{20}$).

There has been charged for tolls and use of motive power on this traffic, the sum of two hundred and fifty-eight thousand three hundred and fifty-nine dollars, thirty-eight cents ($258,359·38), and for passengers, two thousand two hundred and eighty-nine dollars, twenty-one cents. The entire revenue being two hundred and sixty thousand six hundred and forty-eight dollars, fifty-nine cents ($260,648·59). It will be observed that while the amount of tonnage is diminished, and the charge for motive power on the laterals of high grade has also been reduced, there is an increase of revenue amounting to three thousand nine hundred and seven dollars, seventy-five cents. This arises from the augmentation of miscellaneous tonnage, and from the opening of collieries at more distant points of the road; and from present indications there is reason to expect a much greater increase of income from the same causes in future.

Of the several extensions and improvements of the road reported as in hand at the time of the last annual meeting, some have been finished and brought into successful operation, and others have advanced toward completion as far as circumstances have allowed. Upon the extension over Broad Mountain, the work has been retarded by the difficulty, amounting during the spring and summer almost to an impossibility, of obtaining and keeping upon it a sufficient force of laborers and mechanics. As the contractors for the work found it to be impossible to complete their several sections in the stipulated time, even by giving an advance of wages that would entail a heavy loss, it was deemed right to grant such an extension of time as would enable them to wait for the increased supply of laboring hands expected in the course of the autumn and winter. This anticipation had now been fully realized, and the contractors are required to make such additions to their forces as will secure the completion of the grading and bridging, early in the coming spring.

On several miles of the line upon which the grading is finished, the laying of the track has been commenced, and it will be continued on these, and other portions now nearly ready, as fast as the iron is delivered by the manufacturers.

The engines and other machinery for the inclined planes, are in a state of forwardness that will enable them to be erected as soon as the masonry of the foundations is completed, and the latter work is now in hand by skilful and energetic contractors.

In the great coal field which this extension of our road is designed to reach, preparations for mining are actively progressing at several points contiguous to the main line of the road, on a scale of magnitude that affords promise of a large trade immediately on the opening of the road: in addition to which there are numerous openings on large coal seams at points to be reached by short lateral branches that may justify the anticipation of its future increase to any extent the market shall require.

Besides this most important extension, there are several other works of construction that have engaged the attention of the Board, which may be esteemed worthy of mention.

The lateral to Middle Creek, commenced in 1852, was completed early in the last summer; but owing to the difficulties frequently incident to new undertakings, and other causes, the large colliery to which it leads was not brought into successful operation until near the end of the

year; it is, however, reported to be now in a state of completeness and efficiency, that will furnish a tonnage quite equal to the large expectations which led to the construction of the road.

A section of the main line of old road, about one mile long, passing through the gap of Second Mountain, has been re-located in accordance with the general system of improvements described in former reports; and in furtherance of the same system, another section of considerably greater length, extending from the present head of the main road to a point below Minersville, is now being graded on a re-located line which has the great advantage of lying entirely out of the town of Minersville, and also reduces very considerably the heavy grade at Mine Hill Gap.

By the completion of the new engine depot at West Haven, the use of the old depot has been obtained for the purposes of general storage, and for an enlargement of the repair shop; giving sufficient room in the latter for the introduction of additional machinery that was much needed for the proper execution of repairs of engines.

The new freight engines of heavy class with eight connected driving wheels, ordered last winter from the manufactory of Mr. Baldwin, were received from him in due season, and have been found on trial to be more perfectly adapted to the haulage of heavy trains on steep gradients, than any before in use. They not only possess much greater tractive power, but also have greater flexibility on curves, and in consequence of the careful equalization of the weight on the drivers, they produce less maximum pressure on the rails at any single point, than other engines of smaller effective power.

They are believed to be the first ever built with these peculiar excellencies so completely developed, and may therefore be esteemed as models on which it will be advisable to construct the engines that may by required in future for the business of heavy haulage.

The Board has much satisfaction in being able to announce that arrangements have been made, under authority of an Act of Assembly conferring the requisite powers, whereby the coal tonnage of the extensive basin lying west of Tremont will be brought upon our road, on its best route to northern and eastern ports.

This arrangement, which is of a character highly advantageous to all the parties interested, will secure to us a connexion with a mineral field of great importance heretofore inaccessible to any eastern market, and will also make available in due time a line of communication between the Schuylkill coal region and the lower Susquehanna more direct than any other now known.

From the report of the Engineer and Superintendent of the road, Mr. R. A. Wilder, there appears to have been an amount of work done on re-locations of line, relaying old track, construction of new sidings and switches, and short laterals for facilitating the business of the operators at their mines, greater than in any former year.

The length of track laid, exclusive of that on the extension to Ashland, has been thirty-seven thousand one hundred and eighty feet, or a little over seven miles; distributed as follows: New laterals or extensions of laterals, twelve thousand seven hundred and seventy-two feet; new track at new depot, new scales and collector's office, together with a third

track at West Haven, four thousand two hundred and thirty-two feet; new sidings for operators, including over forty switches, six thousand seven hundred and twenty feet. Old track relaid, seven thousand eight hundred and fifty-six feet; on re-locations, five thousand six hundred feet. Of these several tracks, twenty-nine thousand eight hundred and twenty-four feet are laid with new rails weighing sixty pounds to the yard, and seven thousand thee hundred and fifty-six feet with old rails of various patterns. The engineer also makes a statement which it is highly gratifying to be able to record, to the effect that there has not been, during the year, a single instance of loss of life or limb by any passenger traveling over the road, nor any person in the Company's employ.

The tabular statements hereto appended, exhibit the treasurer's accounts showing the condition of the finances of the Company, and the usual statistics of the road and engines.

By order of the Board of Managers,

JOHN C. CRESSON, President.

Philadelphia, January 9th, 1854.

NOTE.—The cost of fuel used for the motive power on this road has been, for coal, wood, and sawing and piling ready for use, $9323·86, equal to 9 cents per mile run by engines, or 15 cents per ton of freight per mile.

AMERICAN PATENTS.

List of American Patents which issued from January 10th, 1854, *to January 31st*, 1854, (*inclusive,*) *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

JANUARY 10.

42. For an *Improvement in Oil Cups for Steam Engines;* David Clark, Philadelphia, Pennsylvania.

Claim.—"What I claim is, constructing the oil cup in the manner described, or in any other equivalent thereto, so that the flow of the oil from the chamber, into and from the chamber, may be regulated wholly by the agency of steam and gravity, as set forth."

43. For an *Improved Press for Veneering;* Lucian A. Brown and Jeremiah W. Brown, Hartford, Connecticut.

Claim.—"We do not claim the method or process of setting or pressing a veneer down on a surface, by the employment of the pressure of water exerted against a flexible material or caul, having the elasticity of vulcanized caoutchouc, nor the application of heat to such caul through such water; but we do claim the employment, in the manner set forth, of a thin metallic plate or caul, not only having the property of flexibility, but that of sufficient tenacity to take out curls, in manner and under circumstances above stated; and we also claim the combination of a flexible metallic caul, with a box having flexible sides. We also claim the combination of the water trough and flanch with the flexible sides, and frames of posts of the box, the same being made to operate substantially in manner and for the purpose as stated."

44. For an *Improvement in Cotton Gins;* Leonard Campbell, Columbus, Miss.

Claim.—"I do not claim the use of brushes suspended in a position so as to allow them to hang loosely between the ginning saws; but what I do claim is, the concave brush ribs and concave brush, in combination with the brush wheel, for the purpose of scouring the

nap (which is formed by the ginning saws) out of the cotton, and, at the same time, remove all impurities or foreign substances from it; said ribs are each of them provided with two rows of short stumpy bristles, which are secured on the inner edges of said ribs as described. 2d, I claim the concave plate for the purpose of regulating the current of air which passes between said plate and the wheel, substantially as described."

45. For an *Improvement in Preventing Dust from Entering Railroad Cars;* Daniel S. Darling, Brooklyn, New York.

Claim.—"What I claim is, arranging a series of deflectors along the side of the locomotive and entire train of cars, in such a manner that a series of funnel-shaped chambers will be formed, which run into each other and form a continuous channel for the dust and air under the car to be confined in, while the funnel-shaped mouths, at the front of the locomotive, receive a powerful outside pressure of air, which, by the position of the deflectors, is forced into less than its ordinary space, and causes an extraordinary suction current under the train, which concentrates and carries the dust arising from the wheels, with it, into the artificial channel under the cars, and confines it until it escapes at the end of the train. The open mouths of the deflectors, on the sides of the cars, also serving as channels for any side dust which may come in contact with them, to be sucked through into the central channel, substantially as described. I also claim the manner described, of reversing the deflectors so that they will effect the desired object, in whatever direction the train is going, substantially as specified."

46. For an *Improvement in Machinery for Mortising Frames for Window Blinds;* D. M. Cummings, North Enfield, New Hampshire.

Claim.—"What I claim is, the movable platform, spacing gauge, and oblique ways, when combined and arranged with each other, and with the adjustable gauge bits, &c., or their equivalents, in such a manner that the mortises formed will be exactly equi-distant from each other, and also, in such a manner that any desired degree of inclination may be given to the said mortises, substantially as herein set forth; disclaiming the use of the said movable platform, save when employed in combination with the spacing gauge and oblique ways, as set forth."

47. For an *Improvement in Clamps for Holding Steel Plates while being Hardened and Tempered;* Charles W. Fillmore, Coral, Illinois.

Claim.—"What I claim is, making the ribs wedge-shaped, thick exteriorly, and thin at the edge where they come in contact with the plate undergoing hardening."

48. For an *Improvement in Attaching Cross Bar Fastenings to Vault and Safe Doors;* F. C. Goffin, City of New York.

Claim.—"What I claim is, the described groove and cross bar, constructed and arranged in the manner and for the purpose substantially as set forth, in combination with the doors, designed to be fortified and secured thereby."

49. For an *Improvement in Cotton Gins;* Benjamin D. Gullett, Aberdeen, Miss.

Claim.—"I am aware that brushes have been so arranged in gins that their bristles extend between the saws, but in such manner that the sides of the bristles would act against the fibre; therefore, I make no claim to any arrangement of bristles acting in that manner, my invention being confined to such an arrangement of the brushes that their bristles will act endwise against the fibre, in which position they are found to brush out the motes with much better effect than in any other; what I claim is, the combination of the mote brushes, arranged and operating in the manner described, with the saw and stripping brushes, substantially as specified."

50. For an *Improvement in Machines for Pegging Boots and Shoes;* Halvor Halvorson, Hartford, Connecticut.

Claim.—"What I claim is, the automatic combination, composed of the following elements, or their mechanical equivalents. 1st, A frame or boot holder. 2d, Machinery for moving the boot holder horizontally, in directions both towards and away from the awls or hole-making contrivances, or in accordance with the horizontal or peripheral curvature of the sole, such mechanism being the guide and bearing point, or tracer, and return spring. 3d, Machinery for raising and depressing such boot holder, in accordance with the vertical curvature of the sole, such mechanism being the guide or cam, and the second frame with its tracer. 4th, Mechanism to give the boot its movement from heel to toe, or vice versa, under the awls or pricking machinery, such mechanism being the screw, cogged wheel,

pawl, or lever, connecting rod, and crank pin, on shaft. 5th, Machinery for holding the strip or strips of wood from which the pegs are to be cut, and regularly advancing such strip or strips, in manner required, towards the cutters, the same consisting of the troughs, and slide or carriage, arranged and operated as described. 6th, A series of cutters, or cutter knives, so made to operate as to cut from the peg strip, pegs, as explained, and hold or retain the same by friction between them, and move such pegs forward to, and directly over the holes in the sole, previously made by the awls or pricking machinery. 7th, Machinery for pricking the holes in the sole, for the reception of the pegs. 8th, Machinery for pressing or forcing such pegs into holes, such being accomplished by the plate, carried and forced down by the punch. 9th, A rocker frame, or swinging lathe, made to support and carry the mechanism above denoted, as the fifth, sixth, seventh, and eighth elements of combination. 10th, Machinery for giving or imparting to such rocker frame its proper movement to insure the correct direction of the awls impuncturing any hole or holes in any part of the sole, such machinery being the movable guide and the tracer, the latter being attached to the rocker frame. And, as auxiliary to the above, or as an improvement, I claim the reversible plate or awl holder, made capable of being turned around, substantially in manner and for the purpose as herein before stated. And I also claim the improvement of so arranging, as described, the awls and machinery that cuts the pegs from the strips of wood, and brings them forward and forces them into the holes, that there shall always be one or more holes made in the sole between the pegs that are being simultaneously made in the sole."

51. For an *Improvement in Heaters for Smoothing Irons;* James J. Johnson, Allegheny City, Pa.

"The nature of my invention consists in giving to a box iron for smoothing clothes, a central conducting mass, for carrying, by means of a largely increased surface and body, the caloric of the heater directly to the smoothing surface of the box iron, this central mass being cast in one body with the box iron, and it and the heater and the box iron corresponding in shape, the one to the other, the heater being thus made in a way to prevent its usual warping, and also to give out a greater amount of heat than could otherwise be attained."

Claim.—"What I claim is, the raised body, as described, and for the purposes described, in its combinations with the heater, with the large central opening to fit the raised body, the raised body, the outer shell of the box iron and the heater being adapted in shape and depth, the one to the other."

52. For an *Improvement in Self-Heating Smoothing Irons;* John Johnson, Allegheny City, Pa.

"The nature of my invention consists in making a hollow iron, with the upper part of the bottom convex, and with two flues commencing at the back end of the iron, which run along the bottom and sides, and unite at the point of the iron."

Claim.—"I do not claim the chimney, wooden handle, and the fastening for the top, &c.; neither do I claim, in general, the use of a distributing flue over the bottom of the iron, as that device has been used before in the self-heating flat-iron of Talieferro & Cummings, patented March 30, 1852; but what I do claim is, the flues around the edge of the bottom, as herein described, in connexion with the convexity of the upper part of the bottom of the iron, for the purpose herein mentioned."

53. For an *Improvement in Machines for Squeezing and Compressing Metallic Bodies;* Ebenezer A. Lester, Boston, Massachusetts.

Claim.—"What I claim is, giving to the hammer or compresser, a positive reciprocating motion, by means of the toggle joint, having a movable fulcrum to let down the hammer as the substance acted upon is being reduced, substantially as described, when this is combined with the bed, composed of rollers, or the equivalent thereof, to hold and turn the ball, or other body, for the repeated actions of the hammer, as set forth."

54. For an *Improvement in Flexible Cordage;* Henry H. Matteson, Buffalo, N. York.

"The nature of my invention consists in forming a cord, line, or belt, which shall be sufficiently flexible to be used, and yet not stretch or shrink by use or exposure."

Claim.—"I lay no claim to the making of cable or cordage of iron; but what I do claim is, the method of making flexible cordage, impervious to moisture, and that will not shrink or stretch by use or exposure, by forming the body or core shreds of whalebone, bamboo,

or rattan, covered by a water proof coating, and the whole completely by plaited thread, substantially as described."

55. For a *Machine for Cutting Ellipses;* Wm. G. Merrell, Auburn, New York.

Claim.—"I do not claim the employment of the trammel, for that is well known as an old device; neither do I claim the method of raising and lowering the bed, that being also an old device; but what I do claim is, the manner in which the driving pulley and cutter stock is made to rotate firmly on the trammel plate, viz: having ways on the upper surface of the trammel plate, and a circular ledge or projection on the under surface, and causing the pulley and cutter stock to press firmly against the ways and ledge or projection, by means of the pins, screws, or nuts, as described."

56. For a *Machine for Matting the ends of Blocks in Making Matches;* Henry E. Pierce, Charlemont, Massachusetts.

Claim.—"What I claim is, matting the ends of match blocks by means of rollers, for the purpose as set forth. And in this claim I do not confine myself to the precise arrangements of the parts described, but shall vary them at pleasure, while I attain the same ends by means substantially the same."

57. For an *Improved Gold Separator;* David Pierce, Woodstock, Vermont.

Claim.—"What I claim is, the gold separating cylinder, with the stepped inclined interior surface and valve opening, constructed and operating as described, or any other substantially the same, and which will produce the intended effect."

58. For an *Improvement in Saw Gummers;* J. P. Spoffard, Brocket's Bridge, N. Y.

Claim.—"What I claim is, the combination of the cutter and collar with the recesses, and so as to change the cutter, when the teeth become dull from use on one part, to the other part, where they are sharp, and thus make it perform double service, substantially as described."

59. For an *Improved Float Valve for Discharging Condensed Water;* Caleb C. Walworth, Boston, Massachusetts.

Claim.—"I claim, in combination with the float, the outlet tube, the valve and opening, (or the mechanical equivalents of said valve and opening,) the second valve and opening, (or the mechanical equivalents for such valve and opening,) so arranged and applied to the tube, and the vessel or float, as to operate to counteract the pressure on the other, or first valve, under circumstances and for the purpose substantially as specified."

60. For an *Improvement in Valves and Valve Seats of Steam Engines;* Stephen D. Wilson, Reading, Pennsylvania.

"The nature of my invention consists in the enlargement and peculiar construction of the steam ports in the valve seats of steam engines, and in adapting the valve to these ports so as to exhaust steam from one end of the cylinder with much greater rapidity than it is admitted into it at the other; all of which is to be accomplished by the same motion, with a single slide valve, and by this means diminish the resistance of the exhaust steam, and increase the power and speed of the engine, with a saving of fuel."

Claim.—"What I claim is, the enlargement and peculiar construction of the steam ports in the valve seats of steam engines, and figures 2 and 3, and in adapting the valve, figure 1, to these ports, so as to exhaust the steam, as herein described, using for that purpose the aforesaid shape and figure, or any other substantially the same, and which will produce the intended effect; and I hereby disclaim title to any original invention of slide valve, valve seat, steam ports, eccentric motion, and any else heretofore known, on which my improvement may be founded, confining my claim strictly to the improvements made on them, as herein described."

61. For an *Improvement in Bedsteads;* Jno. H. Barth, Indianapolis, Indiana.

Claim.—"What I claim is, the notched cheeks, in combination with the shank and catch, as described, for fastening the post to the inner frame, by inserting the shank between the cheeks, in the manner set forth, and giving the post a vertical position, and also causing the speedy disconnexion of the same by the inward inclination of the foot of the post, substantially as specified."

62. For an *Improvement in Torch Lamps;* Harvey Brewer, East Boston, Mass.

Claim.—"I am aware that torches have been adapted to cylindrical reservoirs contain-

ing burning fluid, the handle of the torch or swab closing the mouth of the reservoir and extinguishing the fluid, should it chance to be ignited by returning the torch while burning; I do not, therefore, claim such a device; neither would it answer the purpose where the reservoir is not stationary, or where it is to be attached to the person; neither do I claim any of the details of the construction of my lantern, except such as I shall hereafter specify; nor do I claim the lantern itself, as new, nor the making use of camphene, or any similar fluid, for the purpose of lighting street or other lamps; but what I do claim is, the peculiar construction of the reservoir for containing the camphene, that is to say, the combination of the exterior tube with the interior tube, for the purpose of preventing the liquid from being spilled, should the lamp be overturned, while the reservoir is at all times open for the reception of the torch."

63. For an *Improvement in Filters;* Jno. Kedgie, Rochester, New York.

Claim.—"What I claim is, constructing a filter with an inverted jar, or reservoir, having a detachable perforated base, or bottom, of a concave form, with a flanched or rim edge, having a slot, substantially as set forth."

64. For an *Improved Mortising Chisel;* J. W. McGaffey, Philadelphia, Pennsylvania.

Claim.—"What I claim is, the construction of the chisel, substantially in the manner shown and described, viz: having two cutting lips inserted in a slot or recess in the lower end of a stock, said lips working upon pins which pass through the stock. The inner surfaces of the lips being constructed as shown, and having a tongue working between them, which tongue, when the chisel is raised, forces apart the cutting edges of the lips, and throws out the chip from between the said lips; the cross-bar of the tongue, when the chisel descends, throwing apart the upper portions of the lips, and closing the lower and cutting ends, the tongue being raised between the lips by means of the spring, or its equivalent."

65. For an *Improvement in Mortising Machines;* Hezekiah B. Smith, Lowell, Mass.

Claim.—"What I claim is, the combination for reversing the chisel, by power applied by friction, (with band, or otherwise,) and stops, operated so as to stop the chisel when reversed, in the manner essentially as set forth."

66. For a *Magnetic Toy called the Magnetic Cupid;* James Swain, Philadelphia, Pa.

Claim.—"What I claim is, the combination of the question blocks with adjustable holes, the sliding piece, the toothed wheel, the rotating bar magnet, and the exterior cupid, in the manner and for the purpose, substantially as described."

67. For an *Improvement in Feathering Paddle Wheels;* Thos. L. Jones, Poughkeepsie, N. Y., Assignor (through Horace Dresser) to James B. Jones, City of New York.

Claim.—"I claim, in combination with the mode described, of maintaining the paddles in parallel planes, by means of the suspension ring, making the wheel and paddles in two parts, with a space between for the reception of the suspension ring, substantially as and for the purpose specified."

JANUARY 17.

68. For a *Spiral or Worm-Joint Hinge;* Perry G. Bates, Waterbury, Connecticut.

Claim.—"What I claim is, the spiral or worm-joint hinge, constructed as described."

69. For an *Improvement in Saliva Pumps;* F. Davison, Liberty, Virginia.

Claim.—"What I claim is, drawing the saliva from the mouth, and keeping it dry, during the operation of filling teeth, by means of an instrument constructed with a hollow mouth-piece, which connects with a tube and suction and force pump, in the manner essentially as described."

70. For an *Improvement in Machines for Pegging Boots and Shoes;* Jno. James Greenough, City of New York.

"My invention consists of certain parts, which are for the purpose of forming and driving pegs of wood or metal, into the soles of shoes, boots, &c., or other similar manufactures, and in moving the work up to the pegging apparatus."

Claim.—"What I claim is, 1st, Cutting the peg from the peg blank, by a lateral motion of the cutter against the side of the blank, the cutter assisting to hold the blank in position while it is driven, substantially as described. 2d, I claim the combination of parts, con-

sisting of a revolving plate, surmounted by slides, moving at right angles to each other, when this is combined with the resting of the axis of the revolving plate upon a weighted lever, or its equivalent, so as to rise and fall, for producing a universal movement carriage, as described. 3d, I claim the centre guide for directing the movement of the shoe, or other article, in the course indicated by the groove, or other device substantially the same, for the purpose of keeping the line of the pegs coincident with that of the awl and peg driver. 4th, I claim so constructing, arranging, and operating the shoe carriage, that each point of the sole which is to receive a peg shall be brought successively to the same point under the pegging standard, so that the pegging shall be effected automatically, and without interruption, entirely around the shoe, or other article, substantially as described. 5th, I claim, in combination with the movable carriage, the stationary pegging standard, made adjustable, so that it can be set at any required distance from the centre of motion of the carriage holding the material to be pegged, as above set forth, so that a second row of pegs may be driven within or without the first row, with the same pattern, as described. 6th, I claim driving the pegs by a tool having a positive motion, as described, in both directions. I do not intend, by the above claims, to secure or have granted to myself, any device or combination contained, either explicitly or substantially, in letters patent granted to Joel Robinson, dated October 31st, 1848, or in the specifications, drawings, or model, upon which said patent was granted."

71. For an *Improvement in Diaphragm Pumps;* Daniel T. Hitchcock, Warren, Mass.

Claim.—"I do not claim the pinching of the diaphragm between plates with parallel sides, as this has been done before; but what I do claim is, the securing of an elastic diaphragm between the plates, the sides of which are so inclined as to gradually compress the diaphragm, and take up its elasticity, by which means it is prevented from cutting, substantially as described."

72. For an *Improvement in the Manufacture of Boot and Shoe Soles of Gutta Percha or India Rubber;* E. C. Hyatt and Christian Meyer, Milltown, New Jersey.

Claim.—"What we claim is, 1st, Producing a shoe sole, or other analogous manufacture, in india rubber and gutta percha, in one piece, having variety of thickness in different parts, by the use of rollers, whose surfaces present the reverse of the forms to be produced, at a single operation, substantially as described. 2d, Forming soling of india rubber, or gutta percha, with shanks, fore parts, and heels, of appropriate differences of thickness, in one solid piece, and at one operation, as described. 3d, We also claim forming such soling, or analogous manufacture, in continuous sheets, at one operation, by rolling, as described."

73. For an *Improvement in Machines for Mincing Meat;* Abraham McInturff, Liberty, Virginia.

Claim.—"What I claim is, the employment of the compound cutters, as described, in combination with the holders, operating substantially as and for the purposes set forth."

74. For an *Improvement in Pill Machines;* Loriston G. Merrell, New Bedford, Pa.

"The nature of my invention consists in constructing a machine which will roll the pill mass in a thin sheet, cut it into worms, and then roll it into pills afterwards, coating them with sugar, or any other substance which may be desired."

Claim.—"What I claim is, the combination of machinery, described in my specification as follows, to wit: I claim the revolving segment, with the arrangement of lever and ratchet attached, moving the knife in the manner described; also, the peculiar operation of the fingers which support the pill worm until the proper time for dropping it between the segment and concave, with the coating box attached, and moved as aforesaid, or any other arrangement of machinery substantially the same, and which will produce the intended effect."

75. For an *Improvement in Apparatus for Indicating the Action of the Feed Pump in Steam Boilers;* Thomas J. Sloan, City of New York.

Claim.—"What I claim is, combining with the motor which operates the supply cock or valve, and with the supply pump, or with either, as specified, a mechanism, substantially as specified, which, when the said motor and pump, or either, fail to operate, shall operate the valve of the whistle, or other alarm, to give warning that the apparatus needs personal attention, with the view to perfect safety, as specified."

76. For an *Improved Photographic Plate Vice;* C. W. Stimpson, Cleveland, Ohio.

"The nature of my invention consists in such a construction of the vice, that all the surface of the plate is exposed to the action of the polishing wheel or buffer, with no part of the instrument projecting above the surface of the plate, and so compact and complete within itself, that it can be used in the hand upon a wheel, or be fixed stationary to the bench."

Claim.—"What I claim is, the bed plate, with the ways, in combination with the carriage plate, with the projection and T head and lip, operating in conjunction with the lip upon the main frame. I also claim the manner of securing the carriage plate to the ways by means of the slot and T head, and moving the same backwards and forwards upon the ways, by means of the eccentric or cam lever, in the manner specified. I also claim the arrangement by which the carriage plates can be changed from one side to another, simply by bringing the lever arm back to its farthest point to the left, or in the direction opposite to the course indicated by the arrow. I disclaim the lips and the cam lever separately considered; but I do claim the several parts, in combination, as set forth."

77. For an *Improvement in Tonsil Instruments;* Ira Warren, Boston, Mass.

Claim.—"What I claim in an instrument for the excision of the tonsils, and other analogous operations, is, the crescent-shaped blades, constructed and operating in manner substantially as described, and for the purposes set forth."

78. For an *Improvement in Amputating Apparatus;* Geo. W. Griswold, Carbondale, Pennsylvania.

Claim.—"What I claim is, the combination of the adjustable rest, movable disk, and guide or standard for holding the bone, retracting the flesh, and guiding the saw in amputating limbs; the whole being made and operating substantially as described."

79. For an *Improvement in Clasps;* Chas. T. P. Ware, Assignor to David C. Morehead, City of New York.

"The nature of my invention consists in the construction of a spring clasp, combining the advantages of simplicity, solidity, economy of time and labor in the manufacture, and facility of adjustment, by any known means of securing said clasp in the position in which it is to be used."

Claim.—"What I claim is, the above described spring clasp-lock, so constructed and arranged that the laps shall, when closing, depress the wide end of the tongue, and allow it at last to spring outward into the enlarged space between and above the laps, where it is held firmly by the turned over end of the tongue, or by the thickness of the metal itself; and this I claim, whether used with the projections, for the purposes described, or without them."

80. For an *Improvement in Trusses;* Lewis B. White, Moscow, New York.

Claim.—"What I claim is, the knuckle, the stirrup, the spring, the effect of the bow, substantially as set forth."

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81. For an *Improved Copying Press;* Calvin Adams, Pittsburgh, Pennsylvania.

Claim.—"What I claim is, the combination of the lever bar and upper pressing plate, connected by means of the adjusting screw, and the mode of communicating pressure to the upper pressing plate by means of a cam at the end of a lever, working at the end of the lever bar which sustains the upper pressing plate; also, the use of the finger at the end of the cam lever, in combination with the rest and the other parts of the press, for the purpose of raising the upper platen of the press, and sustaining it in its place while the copying book is inserted or withdrawn, substantially in the manner and for the purpose set forth."

83. For an *Improvement in Wood Saws;* Romes Andrews and Albert F. Andrews, Avon, Connecticut.

Claim.—"What we claim is, the peculiar form and relative position of the planing teeth, in combination with the sawing teeth, substantially as described, and for the purpose set forth."

83. For an *Improvement in Railroad Car Brakes;* L. B. Batcheller, Arlington, Vt.

Claim.—"What I claim is, operating the levers which are attached by the rods, and to

the cross bars, by means of vibrating bars, said bars being moved or operated either by turning the standard, or by the action of the buffer rods upon the levers, both devices being attached to the trucks, and otherwise constructed and arranged substantially as set forth."

84. For an *Improvement in Dumping Cars;* Charles P. Bailey, Zanesville, Ohio.

Claim.—"What I claim is, hanging or connecting the bodies of dumping cars or wagons to the trucks, axles, or bolsters, which usually support the bodies of similar carriages, by my means of hinged cross braces or arms, which pass transversely from end to end, or crosswise of the body, as the case may be, one end of each of said arms or braces being hinged to the body, and the other ends to be bearing or support beneath them, for the purpose of allowing said bodies to swing or dump either way, substantially as described."

85. For an *Improvement in Fancy Check Looms;* Enoch Burt, Manchester, Conn.

"The nature of my invention consists in the position and arrangement of the levers for operating the jacks, viz: hanging them below the web and at a point parallel with, and at about a vertical plane with the 'fell,' or cloth making point, or arranged in any manner substantially equivalent, whereby all the heddles are sprung so as to elevate and depress all the threads of the warp at the same angle, producing very smooth and even sheds, both at top and bottom, in any irregular order desired; the shifting of the jacks are rendered sure and perfect, all jarring or unsteady motion of this part of the machinery, and danger of the jacks hanging upon the said levers, is effectually prevented."

Claim.—What I claim is, hanging the levers or jack lifters below the web, and on a shaft parallel with, and at or about a vertical plane with the 'fell,' or cloth making line, so as to produce an even shed, both at the top and bottom, and render the shifting of jacks from the levers sure, avoiding the jar of the machinery, and obviating the liability of the jacks to hang on the flanches of the levers, substantially as set forth."

86. For an *Improvement in Rosin Oil Lamps;* Silas Constant, Brooklyn, New York.

Claim.—"What I claim is, enclosing the portion of the wick which rises above its guide, within a perforated conical tube, for the purpose of causing a portion of the air that enters the chamber between, and to be brought in contact with the wick which is there in an uncompressed state, and to rise in and about the same to the flame, substantially as set forth. 2d, The draft tube, placed within the burner, and having the button and the perforated and deflecting head combined therewith, substantially in the manner and for the purpose set forth. 3d, The lip, projecting downwards from the under side of the cap, within the series of air holes in the same, for the purpose of preventing gusts of air from producing puffs of smoke up the chimney, substantially as set forth."

87. For an *Improvement in Washing Machines;* William Cunningham, Holliday's Cove, Virginia.

"The nature of my invention relates to the method of hanging the rubber frames so that they may oscillate through the water."

Claim.—"I do not claim the general features of the rubbing frames and plunger; but what I do claim is, the roller frames hung in adjustable boxes, and connected by weighted arms, substantially as and for the purpose described."

88. For an *Improvement in Bee Hives;* John H. Dennis, Boston, Massachusetts.

Claim.—"What I claim is, a moth trap, consisting of a close chamber, having no communication with the rest of the hive, and in which may be placed a vessel containing some fluid attractive to the bee-moth, in combination with a conical or tapering entrance tube, as set forth."

89. For an *Improved Attachment to Piano Fortes;* Spencer B. Driggs, Detroit, Mich.

Claim.—"What I claim is, 1st, The combination of a series of metallic tongues or springs, with the piano forte, or other stringed instrument, in such a manner that a tongue and a string are struck simultaneously, by hammers actuated by a single key, substantially as described. 2d, Actuating the hammers which strike the tongue by means of a jack of any suitable form, attached to the damper of its corresponding string, whereby the said hammer is caused to strike by the raising of the damper, when the piano forte action is brought into play, and thus the tongue and string are struck simultaneously."

90. For an *Improvement in Air Heating Furnaces;* Charles R. Harvey, City of N. Y.

Claim.—"I do not claim a diving flue, or a coil of heating pipe, as they are both well

known devices; but what I claim is, constructing the bonnet or top of the fire chamber with a depression at the centre, into which the smoke or exit pipes enter, so that the heat is equalized all around, and the expansion and contraction is made uniform, as specified."

91. For an *Improvement in Stoves;* Dennis G. Littlefield, Lowell, Massachusetts.

Claim.—"What I claim is, the cylindrical grated fire pot, in combination with the gas receptacle, constructed and operating in the manner substantially as described, by which I am enabled to burn the gaseous and more inflammable elements of the coal in immediate contact with its more refractory portions, and thus ensure the complete combustion of them both."

92. For an *Improvement in Ventilating Railroad Cars;* George Neilson, Boston, Mass.

Claim.—"What I claim is, two or more ranges of sponges, or capillary partitions, as arranged and combined with the cistern of water and open mouthed case, made to communicate with the interior of the car and the surrounding atmosphere, and to operate when the car is in movement, substantially as specified."

93. For an *Improvement in the Manufacture of Hollow Slabs and Flanched Metallic Plates;* Thomas Prosser, City of New York.

"Although I have used the term wrought iron, I mean to apply the same to all and any of the weldable metals, particularly steel and platinum; that I do not confine myself to any particular form or configuration by the term hoop or ring, as that may mean annular, round, square, oval, or any irregular form whatever."

Claim.—"What I claim is, the manufacture of hollow slabs, when the same are made by welding together pieces of metal, in the manner fully set forth and described, or in any manner analogous thereto. I also claim the manufacture of flanched metallic plates, when the same are made by welding together pieces of metal, in the manner fully set forth and described, or in any manner analogous thereto."

94. For an *Improvement in the Feed Apparatus of Straw Cutters;* Harvey Trumbull, Central College, Ohio.

Claim.—"What I claim is, the device for securing the clear passage of the straw, &c., over the intervals between the trough and mouth piece and the lower roller, consisting of fingers, attached to the trough, and passing over the said roller into or upon the mouth piece, and secured from interference with the passage of the straw, &c., by grooves in the face of the roller in which the fingers lie."

95. For an *Improvement in Mills for Grinding Sumac;* Peter Hench, W. S. Hench, and Jerome J. Hench, Port Royal, Pennsylvania.

Claim.—"We do not claim the grinding by balls, as that has long been known, but not in conjunction with a roller, in the manufacture of sumac, which is necessary to detach and partially pulverize, sift the material before carrying it to the balls; what we do claim is, the employment of a cylinder having projecting points or teeth on its internal surface, with a roller, having heads on its ends, on which it rolls and is kept above said teeth; said roller also having teeth projecting from its surface, interlocking with those first named on the cylinder, by which the better portions of the sumac are beaten off and passing through the apertures in the cylinder, enter another, when they are ground fine, as described."

96. For an *Improvement in Machinery for Fulling Cloth;* James H. Jennings and Thomas Brierly, Clayville, New York.

Claim.—"We do not claim either of the individual parts thereof, when taken alone; nor do we claim the combination of the gatherer and horizontal and vertical rollers or fold breakers with a cylinder or wheel, or cylinders or wheels, having a groove therein of flanches on each side, and a cylinder or wheel fitting and working in such groove, or between such flanches; nor the weights and springs to be used upon any or all of such rollers or fold breakers and pressure rollers; but what we do claim is, the application of the above named rollers, formed with flat surfaces, in combination with the gatherer, the horizontal and vertical rollers or fold breakers, and guide, substantially in the manner set forth."

97. For *Improvements in Piston Valves and Steam Passages in Cylindrical Steam Chests;* Joseph Marks, Boston, Massachusetts.

Claim.—"What I claim is, 1st, Constructing a steam chest with continuous circular ports or passages, both for the induction and exhaust steam, arranged as described, so as

to keep a constant and equal pressure of steam upon both ends, and the periphery or outer surface of a cylindrical piston valve, which travels in the bore of the same, and by which, also, is secured a large area of port by a very small movement of the valve; and this I claim, whether the said valve be used as a main valve, cut-off, or throttle valve. 2d, The combination of a piston valve, composed of two heads, which fit closely in the bore of the circular steam chest, and are united by a cylindrical portion of less diameter than the said heads with a steam chest, constructed with circular ports or passages, as specified in the foregoing claim, by which a large exhaust space is secured without increasing the size of the said steam chest, or making it very large, and by which means alone provision is made for the escape of the exhaust steam into the exhaust chamber."

98. For an *Improvement in Threshers and Cleaners of Grain;* James Robinson, West Hebron, New York.

Claim.—"What I claim is, the mode of checking the motion of the carriage when under headway, and steering the same by means of the tightening pulleys, combined as described with the threshing cylinder and a two wheel cart with double gearing. 2d, I also claim the employment, in the manner substantially as described, of the adjusting rods, in combination with the feed roller, for the purpose of regulating the amount of material to be taken up by the feed roller, as explained. I also claim the employment of said adjusting rods, in combination with the feed roller and threshing cylinder, for the purpose of regulating the amount of material to be taken up by the feed roller, and of keeping up the material to the threshing cylinder. I also claim the combination of the adjusting rods, feed roller, and gauge rods, substantially in the manner set forth. I also claim the combination of the gauge rods with the feed roller and concave, or mouth of the concave of the threshing machine, substantially in the manner described."

99. For an *Improvement in Piano Fortes;* Alexander Hall, Lloydsville, Ohio.

Claim.—"I do not claim the employment of extra strings, or extra bridge or bridges, for the introduction of the lower octave notes, as they are set forth in the patent of Simon Draper, granted June 20th, 1845, in which an extra bridge is used, outside the regular bridge, thereby elongating the instrument; but I shall confine my claim to the upper octave strings and bridges therefor, placed within the usual bridges of the piano forte. Therefore, what I claim is, 1st, The mode, substantially as described, of introducing upper octave notes in piano fortes, said mode consisting essentially in the employment of extra strings and extra bridges, as set forth, so that the performer can play in one or more octaves at the same time, with the same facility as he could execute ordinary music on the common piano. 2d, I claim the arrangement of the dampers for the octaves, in combination with the alternate changes of the two upper octave strings to the right and left of the leading strings in each set, for the purposes and substantially in the manner set forth."

100. For an *Improvement in Attaching Shafts to Wagons;* Daniel Haight, Jr., Clinton, New York.

Claim.—"What I claim is, attaching the shafts or tongue, by the lateral insertion of the cylindrical headed drawiron into the circular socket of the jack, by which I am enabled to form a safe and ready detachable connexion between the shaft or tongue and axle, without the use of bolt and nut, or bar, or any intermediate means."

101. For a *Machine for Wetting Paper;* Wm. Overend, Cincinnati, Ohio.

Claim.—"What I claim is, 1st, The yielding gauges, constructed substantially as described, and for the purpose specified. 2d, The combination of the endless bands, the nippers, the rollers, the roller and their bands, the roller with its bands, and counter-balance the carriage with its vertical arm, the pieces, the bent levers, and the cams, constructed and combined substantially as described, for the purpose of taking the wetted paper from the blanket, and conveying it to the movable platform or truck, as set forth. 3d, The combination of the sliding pieces, moving in the vertical grooves, with the arms and the rollers, constructed and combined substantially as described, for the purpose of adjusting the depositing apparatus to the height of the pile of paper, as specified. 4th, The combination of levers with the roller and curved groove, arranged substantially as described, for the purpose of maintaining a uniform tension of the bands, in every position of the depositing apparatus."

102. For an *Improvement in Grain Harvesters;* Aaron Palmer, Brockport, New York, and Stephen G. Williams, Janesville, Wisconsin.

Claim.—"We do not claim the discharging the cut stalks and heads of grain from a

platform by means of the combination of a rake with a lever, and the co-operation therewith of a series of teeth on the face of the main driving wheel, and an inclined rail rising above the curved guard of the platform, as these are already secured to us by letters patent, bearing date July 1st, 1851; but we do claim the method of transferring motion to the rake on the platform from the driving wheel, by means of the double curved rack and pinion on the axle of the driving wheel, the iron arm, latch, and spring, as described. Also, the method of hanging the reel so as to dispense with any post or reel bearer next to the standing grain, as described; thereby preventing the grain from getting caught and being held fast between the divider and a reel supporter."

103. For an *Improvement in Rolling Axles and Shafts;* Jacob Reese, Sharon, Penna.

Claim.—"What I claim is, the method of shaping bars of heated iron into axles and shafts of the usual proportions, and with collars and journals, by rolling them on their own axes, and under pressure between properly shaped converging surfaces, substantially as described: but I make no claim to mere converging surfaces, whether fixed or movable."

104. For an *Improvement in Threshers and Separators of Grain;* Charles R. Soule, Fairfield, Vermont.

"The nature of my invention consists in the arrangement and construction of the straw carrier, the beaters connected therewith, the shoe and its appendages, and the movable board under the straw screen."

Claim.—"What I claim is, 1st, The spring at the end of the feed board, to prevent damage from stones getting into the machine. 2d, The straw carrier and separator, consisting of the notched bars having an endway motion, and the beater, as specified, combined with the movable conducting board for insuring the descent of the grain. I also claim the mode of hanging and moving the shoe, as described."

105. For an *Improved Machine for Making Window Blinds;* Moses C. Stiles and Tristram S. Lewis, Hollis, Maine.

Claim.—"We do not claim the cutter, chisel, or any part of the machine, separately; but what we do claim is, the combination of the cutter and chisel, worked simultaneously by the foot of the operator, or by other power, in the manner and for the purposes set forth."

106. For an *Improvement in Distilling Apparatus;* Carl E. Werner, New Castle, Ill.

Claim.—"What I claim is, 1st, The rim, rising from the floor of the chamber, and encircling the discharging opening of the conducting pipe, for prevention of the interference of steam with the discharging action of said pipe. 2d, Surrounding the entrance of the conducting pipe with an open tubular screen, which rises above the pipe entrance to a height greater than any possible ebullition of the liquid, and terminates below at such portion of the liquid as it is desired to discharge from."

107. For an *Improved Mortising Machine;* Jacob E. Brown and Stephen S. Bartlett, Woonsocket, Rhode Island.

Claim.—"What we claim is, operating the chisel by the graduated conical cam, in combination with the mechanism described, or its equivalent, which enables the operator to vary the length of the stroke made by the chisel while it is in operation, or suspend its motion at pleasure, without disconnecting the driving power applied to operate the machine."

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108. For an *Improvement in Presses for Making Miniature Cases;* Henry T. Anthony, City of New York.

Claim.—"What I claim is, the construction of the platens of a press for applying the covering materials to miniature and other like cases, by forming the face which gives the pressure of elastic materials, whereby the embossed or other raised figures and ornaments will not be obscured or injured during the process, while, at the same time, a superior quality of work is produced, substantially in the manner set forth."

109. For an *Improved Daguerreotype Plate Holder;* Philander H. Benedict, Syracuse, New York.

Claim.—"What I claim is, the arrangement of a vice, or analogous device, upon the side or edge of blocks used for holding daguerreotype plates while they are being polished or buffed, the vice constructed substantially as set forth, and operating by holding the bent edge of the plate between its jaws."

110. For an *Improvement in Cultivators;* Enos Boughton, East Bloomfield, N. Y.

"The nature of my invention consists in running the knife in nearly a flat position, at any required depth under ground, and thereby cutting up and loosening the soil, and also cutting off the roots of thistles, &c., growing therein, and thereby causing them to wilt and die."

Claim.—"I do not claim any part of the raising and depressing device; nor do I claim the knife, or the wheels, separately; but what I do claim is, the combination of the knife with the wheels, for the purpose of cutting up the ground and destroying thistles, or any other weed, plants, or grasses therein."

111. For an *Improved Mode of Fixing Likenesses in Monuments;* Wm. Boyd, Garrettsville, Ohio.

Claim.—"What I claim is, combining with a monument or grave-stone, a case, having a concave mirror set in the back part, and having also within it a miniature likeness of the deceased, which may be kept secure from the action of the weather, or from liability to receive other injury, said miniature being attached to the cover of the case in such way that by opening the cover, the likeness may be viewed by reflection in the mirror, substantially in the mannner set forth."

112. For an *Improvement in Fountain Pens;* William Cleveland, Orange, N. Jersey.

Claim.—"I do not claim the employment of capillary action to supply the ink to the pen, except when used under an arrangement and combination like that herein set forth; said arrangement and combination consisting in the employment of the leading stem so fixed in the delivery aperture that it shall lead the ink down on one side of the aperture, and allow the air to enter the other, in the manner and upon the principles set forth."

113. For an *Improvement in Presses for Moulding Glass;* William O. Davis, Pittsburgh, Pennsylvania.

Claim.—"What I claim is, the combination of the rocking shaft, connecting rods, swinging beam and toggle joint lever, or their mechanical equivalents, as described, for the purpose of procuring a vertical pressure in presses, together with the mode of attaching them so as to relieve the bed plate and frame work of the press of any strain."

114. For an *Improvement in Divided Railroad Axles;* S. L. Denney, Christiana, Pa.

"The nature of my invention consists in forming a gradual conical enlargement for a considerable distance toward the inner end of one part of the divided axle, and terminating said enlargement with greater and constantly increasing abruptness to the end of the axle, and inserting the enlarged end thereof in a cylindrical box, which connects it with the other part of the combined axle, and whose cavity is large enough to admit a layer of some soft metallic alloy to be cast around said enlargement, for the purpose of rendering the combined axle sufficiently inflexible not to wabble, and also to allow one part of it to freely turn, independently of the other, while traversing curves of the road, substantially as described."

Claim.—"What I claim is, the gradual conical enlargement, terminating in the more abrupt curved portion toward the inner end of one part of the axle, in combination with the alloy surrounding it and the adjustable connecting box, arranged and operating as described."

115. For an *Improvement in Cotton Presses;* Cyrus J. Fay, North Lincoln, Maine.

Claim.—"What I claim is, the use of the slats or guide strips, arranged and operating in manner substantially as set forth."

116. For an *Improvement in Saw Mills;* Eleazer W. Johnson, Perth Amboy, N. J.

Claim.—"What I claim is, the arrangement of mechanism for driving two saws or gangs of saws, and placing the whole upon one bed plate, in the manner and for the purposes set forth."

117. For an *Improvement in Propellers;* Harry Leach, Boston, Massachusetts.

Claim.—"What I claim is, the combination with each of its arms, of two parts or floats, (projecting in opposite directions,) and an opening or passage arranged between them for the escape of back water, the whole being substantially as described."

118. For an *Improved Apparatus for Cleaning, Buffing, &c., Daguerreotype Plates;* Thomas Longking, Brooklyn, New York.

"The nature of my invention consists in means for cleaning the plate previous to buf-

fing; this has heretofore been done by hand, the operator using a piece of Canton flannel, on which he puts rotten stone and oil, or similar cleaning material, and rubbing the daguerreotype plate all over with the same, and for this purpose a plate holder is used that can be turned around with one hand, while the plate is cleaned with the other; to accomplish the same object, I use a rotary cushion, over which a cover of Canton flannel, or similar substance, is put, and secured by a ring, the daguerreotype plate being applied to the rotating cushion while held in a proper plate holder, and, in connexion with this cleaning cushion, I use a buffing wheel to finish the polishing of the plate."

Claim.—"I do not claim the buffing wheel, nor any of the parts, separately; but what I do claim is, 1st, Fitting the revolving cushion with the ring, by which the Canton flannel, or similar covering, is secured to the cushion, or removed, and a new cover substituted when required, as specified. 2d, The arrangement of the gearing and shafts, by means of which the cleaning cushion is combined with the buffing wheel, in the manner substantially as set forth."

119. For an *Improvement in Quartz Crushers;* T. O. Cutler, Jersey City, N. Jersey.

"My invention consists in grinding, crushing, or pulverizing quartz, ores, and other substances, by the centrifugal action of rotating or rolling balls that revolve about an axis, when combined with and acting against the inner periphery of a shell or concave which rotates on a common axis with the balls, which shell or concave contains the substance to be ground, &c., which, by the centrifugal action due to the rotation of the shell or concave, is properly distributed, and held in the gutter-like concavity of the shell to be acted upon by the balls in their passage."

Claim.—"What I claim is, the employment of balls to act by centrifugal action due to their rotation about a common centre, substantially as specified, when the said balls are combined and act against the inner periphery of a shell or concave, which rotates on a common axis with the balls, and which, by reason of its rotation, distributes and holds the material to be ground, &c., in the concavity of the said shell, substantially as specified."

120. For an *Improvement in Shutter Hinges;* Harvey Lull, South Coventry, Conn., Assignor to Self and Richard Porter, Wheeling, Virginia; dated January 31, 1854; ante-dated January 2, 1854.

Claim.—"What I claim is, the so forming of a self-locking shutter hinge, cast in two pieces, as that the blind or shutter hung thereon may swing open or shut on a horizontal plane, and lock when opened to its limit, and so that also when locked open, the strain shall be taken off from the spindle and thrown on to cam arms, and thus effectually relieve the spindle from the weight or strain of the shuttle, substantially as described."

121. For an *Improvement in Rollers for Scarfing the Edges of Skelps for Lap Welded Tubes;* James McCarty, Reading, Pennsylvania.

Claim.—"What I claim is, a pair of rollers, constructed, arranged, and adjusted, substantially as described, so as to bevel the opposite edges of skelp plates of different widths, on opposite sides of the same."

122. For *Improvements in Steam Hammers;* John L. L. Morris, Reading, Penna.

Claim.—"I do not claim attaching the hammer to a beam which is operated by a piston in a steam cylinder, when the hammer is connected rigidly to the beam, as that would be equivalent to what is known as the helve steam hammer; but what I claim is, 1st, Admitting steam to the cylinder above the piston, and exhausting the steam therefrom through ports, and which are opened and closed by an annular valve working in the cylinder itself, or in a steam chest, which is placed above and forms a continuation of the cylinder, substantially as described. 2d, I claim the combination of a bell crank latch lever with a trigger or catch of, or other shape, capable of operating, as described, when the fulcrum of the said catch lever block and one end or arm is attached to the connecting rod of the hammer block, and receives the necessary movement to actuate the trigger or catch, to set free the valve rod by means of a continued descent of the connecting rod after the hammer is arrested by striking the blow, as and for the purpose set forth."

123. For an *Improvement in Electro-Magnetic Engines;* Chas. G. Page, Washington, District of Columbia: patented in England, May 3, 1851.

Claim—"What I claim is, the employment of the axial action or force of the electric current as a mechanical agent or motive power, for the various purposes herein named, the power being produced by the combination or united operation of a helix or helices, an axial bar or bars of iron, and a cut-off, or its equivalent, for regulating the motion of

the axial bar or bars, under a general arrangement in principles substantially as set forth. And I also claim the employment of co-operating electro-magnets or armatures, in combination with axial bars, helices, and cut-off, or its equivalent, substantially as set forth. Lastly, I claim the employment of square wires in the construction of helices for electro-magnetic purposes, substantially as set forth."

124. For *Improvements in Water Gauges for Steam Boilers;* W. Palmer, City of N. Y.

Claim.—"What I claim is, the use of the double tubular case, in combination with the lever, having a float at one end working in one of the tubes, and a compensating plate, or equivalent device, at the other, working in the opposite tube, for the purpose substantially as set forth. I also claim the use of the lever, having a float at one end of it, and a compensating plate at the other, whether working in a double tubular case, or otherwise, in combination with an upper and lower rod valve for operating a ball by means of the steam escaping through these valves, whether using the paddle wheel, or any equivalent device, for that purpose, to indicate the minimum or maximum of the water in the boiler, substantially as set forth."

125. For an *Improvement in Manufacture of Sheet Iron;* Ebenezer G. Pomeroy, Pittsburgh, Pennsylvania.

Claim.—"I do not claim the use of the above materials, in combination, as a paint or composition that may be forced into the surface of iron; but, believing that I am the first person who has ever incorporated solid carbonaceous matter with the surface of iron, by mechanical force, what I do claim is, the incorporating, substantially as described, solid carbonaceous matter with the surface of iron, so as to protect it from oxidation, and beautify it at the same time."

126. For an *Improvement in the Construction of Printing Blocks;* Benjamin Underwood, Brooklyn, New York.

"The nature of my invention consists in providing a series of suitable movable types of wood, metal, or other material, and so arranging them together that they shall, collectively, constitute blocks, patterns, designs, or devices, with which ornamental figures and designs may be printed upon oil cloths, carpets, and other fabrics, in one or more colors, just the same as if the said blocks had been engraved or carved, according to the usual mode."

Claim.—"I claim the peculiar construction of the type described, so that when combined in a case, such as specified, any given design may be produced for printing oil cloths, carpets, or other fabrics, as fully set forth. I also claim the formation of blocks for printing oil cloth carpets, or other fabrics, by the combination and arrangement of sections of type, such as particularly described, by which an endless variety of patterns may be produced from the same sections, variously dispersed, at a comparatively small cost."

127. For an *Improvement in Carpet Bags;* Frederick J. Thring, City of New York.

Claim.—"What I claim is, constructing the carpet bag with its top and bottom of equal or nearly equal widths, and arranging round its front a strong metallic frame, and attaching to the front, and near the centre of said metallic frame, by hinges or loose joints, a metallic swinging cover, which extends from the centre to the top of the frame, and has a ledge on its inner face, the said cover serving to close up the mouth of the bag, and in connexion with the metallic frame, to keep out all dust and rain; the whole being constructed, arranged, and operating in the manner and for the purposes specified."

128. For an *Improved Machine for Paging Books;* Edward Town, Jersey City, N. J.

Claim.—"What I claim is, the arrangement of type in spiral columns around a cylinder, for the purpose of printing successive numbers; the cylinder being moved laterally while it revolves, by means of a screw on the end of its shaft, substantially as described. I also claim the right to use any number of cylinders on a single machine, for the purposes set forth."

129. For an *Improvement in Steam Hammers;* Peter L. Weimer, Reading, Penna.

Claim.—"I make no claim to being the originator of not admitting steam into the cylinder until after the hammer has struck its blow; the same being effected by others, though by different arrangement of device from that which I employ. I do not claim admitting steam into the cylinder of steam hammers by means of the recoil of the anvil, caused by the blow of the hammer; but I do claim the arrangement of the toggle, the catch, the arm, the arm *x*, the weight, and shaft, for the purpose of opening the valve admitting steam

into the cylinder from the concussion or spring of the anvil in its bed, caused by the force of the blow of the hammer."

130. For an *Improvement in Churns;* Isaac L. Dickinson, Richmond, Indiana.

Claim.—"What I claim is, the combination of the movable or rotating dashers with the breakers, constructed and operated as described, so that said breakers may remain stationary while churning, and revolve with the dashers to collect the butter, substantially as described."

131. For an *Improvement in Furniture Casters;* Le Roy S. White, Chicopee, Mass.

Claim.—"I do not claim the invention of making the shank of the caster detachable from its socket; nor do I claim the employment of a spring to hold the shank in the socket, nor the arrangement of said spring in a groove made in and around the shank, and the making the spring to bear against the internal surface of the socket, made without a groove; but what I do claim is, the arrangement of the sustaining groove of the spring in the socket, instead of in the shank, so that when the shank is being drawn out of the socket, or when it is within or out of the same, the spring will remain in the socket. And, in combination with the spring and grrove made in the socket, I claim to make the groove of the shank with its upper side flaring, and the upper end of the shank beveling, as described, or as represented in the drawings, the said flare of the side of the groove and the top, rendering the shank capable of being detached from or attached to the socket."

RE-ISSUES FOR JANUARY, 1854.

1. For an *Improvement in Utilizing Slags of Furnaces;* William H. Smith, Philadelphia, Pennsylvania; patented December 7, 1852; re-issued January 3, 1854.

Claim.—"What I claim is, the process, substantially as described, of producing ware from the slag, or scoria ejected from smelting furnaces, for reducing iron, copper, zinc, and other metals, by separating these from, and casting, moulding, blowing, or pressing the same in the heated state, as it comes from the smelting furnace, and then annealing, whether additional heat be applied, or not, substantially as and for the purpose specified. And I also claim the method of obtaining slag or scoria from smelting furnaces, in a vitrified state, fit for remelting, to be worked into ware, substantially as described, by casting it into thin sheets on to cold plates of metal, or other good conducting substance, as specified."

2. For an *Improvement in Looms for Weaving Figured Fabrics;* Cornelius W. Blanchard, Clinton, Massachusetts; patented Aug. 3, 1852; re-issued Jan. 3, 1854.

Claim.—"What I claim is, 1st, The combination of the angularly moving catch bars, operated substantially in the manner described, with the shifting hooks hung on the jacks, so as to vibrate independently thereof, for the purpose of connecting and disconnecting the jacks with the said catch bars. 2d, The method, substantially as described, of combining and arranging the parts for turning the figuring chain or cylinder in either direction."

3. For an *Improvement in Stuffing Boxes;* Thomas W. Allen and Charles W. Noyes, Greenbush, New York; patented Nov. 6, 1847; re-issued Jan. 10, 1854.

Claim.—"What we claim consists in combining with a stationary stuffing or packing box, a cup or ring, or its equivalent, through which the piston rod or shaft passes, and works so fitted, substantially as described, that the end thereof shall make a close joint by means of end pressure at the bottom of the stuffing or packing box, and be free to slide thereon laterally, to follow the vibrations of the piston rod or shaft, as set forth. And we also claim making the inner bore of the cup conical, in combination with the cut metallic rings fitted thereto, substantially as described, so that by the application of end pressure, the cut rings shall be forced into close contact with the periphery of the piston rod or shaft, and the end of the cup into close contact with the bottom of the box, as described, and thus effectually prevent the escape of steam, or other fluid, and, at the same time, permit the required lateral play, as set forth."

4. For *Improved Valves for Governors;* Junius and Alfred Judson, Assignors to Junius Judson, Rochester, New York; patented Nov. 5, 1850; re-issued Jan. 10, 1854.

Claim.—"We do not limit our claim to the special form of valve opening described, as the form may be greatly varied, and yet act upon the principle specified, as constituting the chief characteristic of our invention. Nor yet to limit ourselves to the form of the aperture or apertures, as the same end may be obtained on the same principle by the joint

form of the opening or openings and valve governing the same. Nor do we wish to limit our invention to the making of such governor valve with the aperture or opening thereof, on the principle specified, throughout the whole range of motion, as in many instances it may be advantageously employed with the said principle, acting only on a part of its range of motion, where engines are employed under such circumstances that they will not be exposed to serious perturbations above or below a certain range; but we do not wish to be understood as claiming, broadly, the making of the apertures of governor valves of capacities varying, independently of the range of motion of the valve, as the well known throttle valve, and valves with circular apertures, have not a constant increase or decrease of capacity proportioned to the range of motion. But we do claim making the opening or openings, controlled by the governor valves of steam engines of gradually increasing capacity, from the closed towards the open position, substantially in the manner and for the purpose specified. And we also claim interposing a spring between the valve cover and the set screw, or its equivalent, which determines or sets the position of the face of the valve to its seat, so that the tension of the said spring shall resist the pressure of the steam on the valve cover, and thereby produce an increased flow of steam to the cylinder, substantially as specified. And we also claim the employment of the valve lever, adjustable to the stem of the valve, in combination with a fixed indicator, substantially as specified, for the purpose of setting the valve in any required position without opening the valve box, as set forth."

5. For an *Improvement in Portable Horse Powers;* John A. Taplin, Fishkill, N. York: patented December 30, 1841; re-issued January 24, 1854.

Claim.—"I do not claim the making of the large wheel of a horse power in segments merely; but what I do claim is, such a wheel and axle, composed of a number of parts, arranged and connected substantially in the method described, so that the wheel can readily be taken apart and put together again, to facilitate the frequent removal of the horse power from place to place, to bring it near the work on which it is to be used. I also claim connecting the segments of the rim of the horse power by means of clamps, constructed as set forth."

6. For *Apparatus for Opening and Closing Gates;* Samuel G. Dugdale, Richmond, Indiana; patented October 11, 1853; re-issued January 31, 1854.

Claim.—"What I claim is, 1st, Opening, closing, fastening, and unfastening the gate, by moving the bottom of the gate in an oblique direction from and to the post upon which it is hung, as specified. 2d, I claim the use of the pendulous and vertical levers and arms, and, in combination with the hinges of the gate, the whole being operated and arranged, substantially in the manner and for the purpose as set forth."

Designs for January, 1854.

1. For the *Frame of a Footstool or Ottoman;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, January 3.

Claim.—"What I claim is, the new design, consisting in the ornamental figures."

2. For a *Hall Stove;* William Resor, Assignor to William and R. P. Resor & Co., Cincinnati, Ohio, January 3.

Claim.—"What I claim is, the ornamental design or pattern."

3. For the *Frame of a Footstool or Ottoman;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, January 3.

Claim.—"What I claim is, the new design, consisting in the ornamental figures."

4. For a *Laundry Stove;* William Resor, Cincinnati, Ohio, January 17.

Claim.—"What I claim is, the ornamental pattern or design."

5. For a *Dining Room Stove;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, January 24.

Claim.—"What we claim is, the figures, scrolls, and mouldings, forming an ornamental design."

6. For a *Cooking Stove;* Conrad Harris and P. W. Zoiner, Cincinnati, Ohio, Jan. 24.

Claim.—"What we claim is, the ornamental design."

7. For a *Shovel and Tongs Stand;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, January 24.

8. For a *Shovel and Tongs Stand;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, January 24.

Claim.—"What I claim in these patents are, the new designs, consisting in the ornamental figures."

9. For a *Cannon Stove;* William Resor, Assignor to William and R. P. Resor & Co., Cincinnati, Ohio, January 31.

Claim.—"I claim the ornamental design or pattern."

10. For a *Stove;* Conrad Harris and Paul William Zoiner, Cincinnati, Ohio, Assignors to Alexander Bradley, Pittsburgh, Pennsylvania, January 31.

Claim.—"What we claim is, the ornamental design."

11. For a *Stove;* Peter Seibert, Assignor to Alexander Bradley, Pittsburgh, Pa., Jan. 31.

Claim.—"What I claim is, the ornamental design."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

On Alexander & Morfit's Process for Organic Analysis. By CHARLES M. WETHERILL, Ph. D., M.D.

In the last number of the Journal, there is described an "improved" apparatus for Organic Analysis, by J. H. Alexander & Campbell Morfit. This process has been in use for some time in Germany, and was proposed by Hess, whose description may be found in *Poggendorff's Annalen* and in Erdmann & Marchand's *Journal fur Practische Chemie*, (vol. xvii, pages 98 and 399, year 1839.) It is also described in the last edition of *Rose's Chemistry*, and in the second supplement to *Poggendorff's Dictionary of Chemistry*. Erdmann & Marchand, as well as Wöhler, have employed it with modifications of their own; and since the method is an exceedingly neat and cleanly one, and since Alexander & Morfit have introduced modifications not, as I think, to its improvement, it may be worth while to occupy a short space in the Journal with a description of the process, from the above sources, and which may be illustrated by the cut in the former number of the Journal.

The combustion tube is about 17 or 18 inches in length, and instead of a stop-cock immediately before it, a rod of 10 inches in length is fastened to the cock of the gasometer to enable one to regulate the flow of the oxygen with greater delicacy than can be effected in the ordinary way, and upon the proper regulation of which depends the accuracy of the process. The tube is heated by an alcohol lamp, which consists of a long and narrow trough, connected by means of a tube, with an alcohol reservoir similar to the oil lamp with inverted cistern; wick holders of tin, of a rectangular section, are made of such size that they fit easily in the trough; these are added and lighted, one after another, as occasion requires. The contents of the combustion tube are arranged differently by different chemists; but in all cases a re-agent such as oxide of copper is necessary. This cannot, in most instances, be omitted, as Alexander & Morfit have proposed, since the greater portion of substances

subjected to analysis would give off liquid or volatile products of dry distillation, before the temperature is reached at which they would unite with the oxygen. Anthracite coal, or such bodies as would not yield volatile products at a low temperature, might, indeed, be subjected to this process. Perhaps experiment would show that a long portion of the tube filled with asbestus, placed beyond the substance and kept at a high temperature, could replace the oxide of copper.

Oxide of copper, therefore, or some similar re-agent, must be used in the combustion tube. Some prefer to make the mixture as in Liebig's process. Erdmann & Marchand introduce the oxide of copper alone and for two-thirds its length, into the tube, which is closed at the further end with a dense plug of copper turnings, and heat the tube, passing slowly a current of dry air, (which requires a quarter of an hour,) and let cool. The organic substance is then introduced and mixed with the oxide of copper by means of a copper wire, fashioned at the extremity like a corkscrew, and the remaining space is filled with oxide, which has just been ignited over the lamp, in a platinum crucible. The pure oxide of copper, at either end of the tube, is first heated by adding the wicks, and finally the mixture itself, passing, at the same time, a slow current of dry oxygen. The corks are not dried; but evaporation and absorption are prevented by coating them with lead foil. This is effected by placing upon the cork a small disc of foil, of a couple of lines greater diameter, and with a pointed glass rod, which fits the hole, breaking through the foil and pressing it against the inside of the cavity; the Ca, Cl tube is then carefully introduced at the other end.

Hess (in his original memoir) and Wöhler, introduce the organic substance in a little boat of platinum or glass, which enables the residue, where there is any, to be further treated.

In combustions of salts of the alkalies or alkaline earths, where the boat contains resulting carbonates, the apparatus which I have described in the May number of the last year's Journal will be found convenient for determining this carbonic acid, as it is well calculated for small quantities of substance.

In all cases, the regulation of the oxygen stream is an important point, and should be such, that when the apparatus is filled with carbonic acid, almost no gas (in case of nitrogen free bodies) passes through the potash apparatus. Cases of carelessness in this respect, Hess says, may be detected by applying a light to the end of the potash apparatus, which causes slight detonations of the mixture of oxygen with the unconsumed inflammable gases of the substance. Erdmann & Marchand employ, in addition to the oxygen gasometer, one containing air, and milk of lime instead of water, which is used for heating the oxide of copper, and for cooling, at the close of the operation, in a current of air.

For those regardless of expense, and who are disgusted with the intolerable heat of a combustion in summer, and with the ashes of the charcoal, which fill the laboratory, Hess' process is a very acceptable one. He calculates the quantity of alcohol for one combustion to vary from a little less than a *litre to one litre and a-half. Where gas may be had, it forms an advantageous substitute for alcohol. Apparatus for combus-

* Litre, two and one-tenth pints.

tions by gas have been described by Kühn Liebig's *Annalen*, lxxiv, p. 115, by *Beale Pharm. Jour. Transactions*, x. 9, by Sonnerschein, Erdmann & Marchand's *Journal*, lv, p. 478, and by *Magnus*, idem, lx, p. 52.

I have been myself engaged in perfecting an apparatus for combustions with illuminating gas, a description of which, if it stands the test of experience, will appear in some future number of the Journal.

The other modification of the Hess process, proposed by Alexander & Morfit, consists of measuring the oxygen used for the combustion and examining the gaseous products of combustion, to serve as a control for the analysis. As they have not given the results of such controlling experiments, compared with the analysis itself, it was, probably, found not to answer their expectation. The father of organic analysis, Lavoisier, first employed the method of determining the elements of an organic substance, by comparing the oxygen used in combustion with the products of combustion, and determined the composition of coal, wax, alcohol and sugar. Saussure & Prout have both described processes of the same nature. To be of any avail as a check to the analysis, the controlling process should be of at least equal accuracy with the analysis itself; and it is difficult to see how an accurate determination of the oxygen used can be obtained by the method described by Alexander & Morfit. On the perfection of the modern process of organic analysis, all such methods were generally abandoned as being (with the same degree of care) much less accurate and much more difficult to carry on with proper results.

For the Journal of the Franklin Institute.

Large Steamer.

The Fall River Steamboat Line (one of the lines between New York and Boston,) are now building the largest steamer, of her class, in the world; the following are a few of her dimensions:—

Length of keel,	325 feet.
Breadth of beam, inside of wheels,	45 "
Depth of hold,	15 "

Single engine with top lever.

Diameter of cylinder,	8 feet 9 inches.
Length of stroke,	12 "
Diameter of paddle wheels,	40 "

With four tubular boilers placed on guards.

Hull of boat by Samuel Sneden, of Green Point; engine by Stillman, Allen & Co., of New York.

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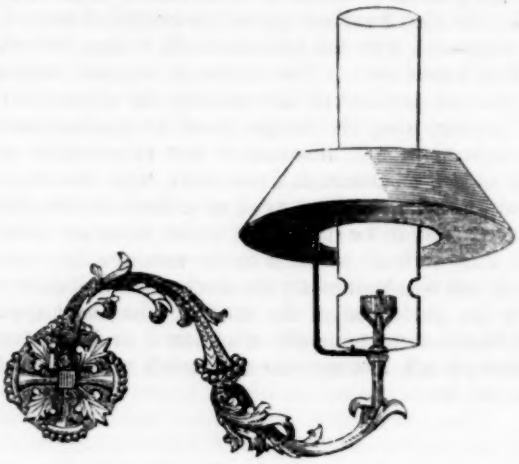
*Boggett and Pettit's Patent Dioptric Refractors.**

It is well known to those who are acquainted with the principles of optical science that when light passes from one medium into another in any direction not perpendicular to the surface dividing them, that direction undergoes a sudden change, called refraction. The amount of this

* From the London Mechanic's Magazine, November, 1853.

change of direction or divergence is dependent on the angle at which the light enters the refracting medium, or the angle of *incidence* as it is called. To take advantage of this principle in utilizing to the utmost extent the light derivable from gas and other burners of the description in every-day use has been what Messrs. Boggett and Pettit have proposed to themselves, and that they have succeeded admirably admits of no question. The accompanying engraving represents one of their new dioptric refractors applied to a gas burner. The instrument, it will be seen, consists of a



glass ring of a prismatic section placed so as to surround the flame at such a height that all the lateral rays of light proceeding from it are intercepted by the ring, and, falling on its inclined exterior surface, are projected downwards and concentrated within the range of the refractor. This range will depend on the angles given to the interior and exterior surfaces of the prismatic ring, and can evidently be increased or diminished by making the angles between the sides and the base of the prism greater or less. The effect produced by the arrangement is such as could not fail to excite the attention of even the most cursory observer; and we predict for the invention a long and successful run. It is not indeed under all circumstances that it is desirable so to concentrate the light: but for all show purposes, and to enable delicate mechanical or other operations to be performed with artificial light, this is absolutely necessary; and there is no contrivance by which this can be done so effectually as by the present.

Messrs. Boggett and Pettit propose also, where a lighter refractor than one composed of solid glass is required, to make hollow refractors; that is, to combine a series of prismatic rings of much smaller sectional area and of gradually decreasing diameter, in the manner of a flight of steps; the exterior inclined surface being, however, always plain and the interior one step-fashioned. This arrangement is found to produce an equally good effect.

*Ocean Steamers.**

(Continued from page 66.)

The discussion being resumed on "Ocean Steamers," it was contended that the statement of a supposed wave pressure of 85,000 tons of water, or even of 40,000 tons, to which it had since been reduced, by a modified estimate, was inadmissible; it would be manifestly impossible for any vessel to withstand such impact from a body of water; and if the position was admitted, it must be evident, that any of the ordinary coasting steamers would constantly be liable to a pressure of 1000 to 1500 tons, which would suffice to utterly destroy them.

The comparison of the qualities for safe riding, when lying-to between a line of battle ship and a privateer, was not to the point, as the former was encumbered by the enormous weight of her armament, and by her top hamper; in short, the whole misconception had arisen from confounding the wave of oscillation with that of translation; this was exemplified by the case of a disabled vessel; as long as she remained afloat she was comparatively safe, but, as soon as she touched the ground, and the wave of oscillation became one of translation, she was immediately knocked to pieces by the impact of the waves.

Next, as to the proportions of 6 to 1, which had been derived from as ancient a type as Noah's Ark—now, as far as was known, as that construction had not been designed either for sailing or steaming, but only to float with a very large cargo, it afforded no analogy for vessels built for speed, however propelled; and, in fact, modern fast sailing vessels had abandoned those proportions, which had only been perpetuated by the old tonnage laws, under which merchant vessels were enabled to be constructed to carry enormous cargoes, but they were unable to attain any considerable speed. It was further argued that, as steam propulsion was employed, the analogy became still less apparent; and, as an instance of the advantage of lengthening ships, the case of the vessels belonging to the North of Europe Steam Navigation Company was mentioned. The *City of Norwich*, 183 feet long, 26 feet beam, 471 tons burthen, and 200 horse power, could carry, as cargo, 220 head of cattle, at a speed of 10 knots per hour, but she rolled considerably with a beam sea; whilst the *Tonning*, 222 feet long, 27 feet beam, 734 tons burthen, and 200 horse power, carried 360 head of cattle, at a speed of 12 knots per hour: she was a remarkably easy vessel, and had proved her sea worthy qualities by coming safely round the coast of Scotland, during the late gale in September. Thus, with the same engine power, by merely altering the proportions from 7 to 1 to 8 to 1, nearly 60 per cent. more cargo space was obtained, and 2 knots per hour were gained in speed, with improved sea-going qualities. It must be remarked, also, that the relative proportions of the *Tonning* were almost identical with those of the proposed iron vessel for the Eastern Steam Navigation Company.

Taking the *Wave Queen* as an extreme case—her length being 213 feet with 15 feet beam, and proportions of 13 to 1, with a draft of water of only 5 feet, and comparing her performances with those of the

* From the London Artizan, January, 1854.

Christiana, a good vessel, about 170 feet long, and with about the proportion of 6 to 1—it was found that, whilst the latter, in a moderate head sea, continually shipped the waves, the former, in a similar sea, was perfectly dry. This evidence was given from the personal experience of the speaker.

The *Wave Queen* had since been running between Newhaven and Dieppe, and it was to be expected—indeed, it had been predicted—that, from local circumstances connected with the entrance of the harbor at Newhaven, she would meet with some casualty. She was not stranded in consequence of any inefficiency in the power of the rudder, but, after a very bad passage across the Channel, in the trough of the sea, which was running very high, she arrived off Newhaven when there was scarcely depth of water over the bar for her to cross; she touched the ground heavily, and hung by her "heel;" a beam sea catching her at the same moment, swung her round and threw her broadside on the beach, where all the passengers were safely landed. It was a good proof of the strength that could be given to iron ships, that, though she was thrown broadside on the shore by the waves of translation, she was safely got off and brought round to the Thames without material damage.

As to the elaborate calculations entered into, with respect to the three great navigation projects—before admitting the correctness of those results, it must be clearly understood, that the *Rattler*, which had been used as the type, was built during the most pressing period (scientifically) of construction in H. M. Dockyard. Her dimensions were 176 feet long, by 32 feet 6 inches beam—a proportion of about 5½ to 1; and, from what had been published, it must be evident, that she had just performed what might have been anticipated from such proportions. At the time of the construction of the engines of the *Rattler*, marine engineers had scarcely adopted, and rarely practised, the use of the steam at a certain amount of pressure, and expanding in the cylinder, whereby such a vast economy in the consumption of fuel is now realized. Now, if the calculations of fuel required for long voyages were based upon the old scale of consumption, instead of the present rate, which, in good ships, did not exceed 3½ pounds per *real* horse power, the deductions from the calculations must be still more unexceptionable.

It was then contended, that all arguments based upon calculations of the speed and other qualities of such type, must be utterly fallacious. It had been shown what inscrease of peed and of carrying qualities had been produced by lengthening the *Tonning* without increasing her power, and, by analogy, it was only reasonable to presume, that if the proportions of the *Rattler* had been altered from 5½ to 1 to nearly 8 to 1, there would have been a still more striking amelioration, and she would have been a more trustworthy type for the calculations and arguments as to the practicability of constructing and of commercially working large ships. It was argued that, with all these and many other examples to the contrary, it was evidently incorrect to attempt to assume that 6 to 1 was the best proportion for vessels of any kind.

It was assumed, that when it was stated a large steamer was intended to run to India or Australia, and back, without recoaling, it was only

meant that she would carry enough coal to avoid detention at the intermediate ports, as (unless it was ascertained that she could not procure a more profitable cargo) it would, evidently, be more economical to send coals to the ultimate and distant port by sailing vessels, who would convey them cheaper than she could do.

It must not be supposed, that the meeting received for granted the results of calculations based in such a type as the *Rattler*, nor that the institution could pretend to do more than offer a field for the investigation of the scientific portion of the magnificent commercial experiments about to be tried, and for the success of which all must unite in offering their best wishes. Engineers, unless especially called upon to give opinions on the prospects of commercial success offered by undertakings, were only expected to consider the best means of executing given works at the cheapest rates, compatible with security and durability, but the ultimate remuneration for the outlay must be mainly a subject for the consideration of the speculators.

The advantages of employing a smaller number of large ships, rather than a greater number of small ships, for a given trade, especially for long voyages, was beginning to be generally admitted by ship owners. A return was published in the *Times* of November 22d, 1853, copied from the *Liverpool Albion* of November 21st, which presented the results of that experience in a remarkable form.

"The following table shows the average number of days occupied on the passage by the vessels of different tonnage, ranging from 200 tons upwards, dispatched from Liverpool to Australia, in the years 1852 and 1853:—

TONNAGE.	1852. Average number of days.	1853. Average number of days.
Under 200 tons,	137	133
From 200 to 300 tons,	122	122
" 300 to 400 "	123	113
" 400 to 500 "	118	112
" 500 to 600 "	113	112
" 600 to 700 "	107	103
" 700 to 800 "	108	101
" 800 to 900 "	103	100
" 900 to 1000 "	102	95
" 1000 to 1200 "	96	91
" 1200 and upwards,	91	90

"From the above table, it will be seen that, in almost every instance, the average is in favor of the largest ships, the 600 ton ships having an advantage of 24 days, on the average, in 1852, over the 200 ton ships, and the 1200 ton ships having an advantage of 22 days over the 600 ton ships. In 1853, also, it will be seen that the results are much the same."

But even with this evidence, it would not be wise to rush to the conclusion, that vessels of enormous size would be applicable in all circumstances; in fact, that which determined the expediency of using a large ship was the coincidence of a great amount of traffic and great length of

voyage. For example, it might be questioned, except for some special branches of commerce, which appeared now about to be greatly developed, whether a very large ship would be likely to be commercially beneficial, between any two ports of Great Britain.

It must be evident that, for each length of voyage and description of trade, there was a particular size of vessel, that would be most suitable; and, indeed, as in most other engineering works, the circumstances of the traffic would of themselves mainly determine the proportions of the structure. Take, for example, the trade between England and America, as originally opened by the *Great Western;* that vessel, as first designed, although much the largest ship of her day, was of the smallest size by which such a trade could be conducted, and her length was actually increased, during her construction, to a point then generally considered dangerous.

Since that period, all vessels on that station had been successively augmented in dimensions, as the trade increased; but even those vessels were too small for the Australian voyage of 25,000 miles, and the necessity of increasing the length was shown, by calculating how much coal would require to be carried, beyond that needed for an American voyage, in order to do the Australian or the Indian voyage equally well. Such calculation demonstrated, that a vessel similar to the *Great Western* would require to be lengthened to 520 feet to accomplish that voyage. This argument showed, that the conditions of the case compelled the adoption of vessels of extraordinary length for steam voyages of extraordinary distance.

Then, as to the commercial question, the merchants engaged in the Indian and Australian trade had calculated, from the data afforded by their own business, what amount of freight and passengers would require accommodation, and it was found, that the quantity was greater than could be received by the ship just calculated. The dimensions, therefore, required to be enlarged, to meet the demand of the existing trade. Thus the traffic itself did actually fix the dimensions of the proposed large class of vessels.

As to the mechanical strength of such vessels, there was no difference of opinion on that point, among engineers, provided the structure was of iron. Ships of wood, on the contrary, were limited in size, by the nature of the material, which was *grown*, and not *manufactured*, and therefore the produce was of limited size; whereas, plates of iron could, on the other hand, be rolled of any required dimensions. It must be observed, also, that the strength of wood across the fibre was so small, that two planks could not be so united as to be equally strong in all directions, whilst two plates of iron, riveted together, were of nearly uniform strength.

Further, as to the resistance of large vessels to waves, it was evident that the waves of the Atlantic, being of the same size, whether the vessel was small or large, their proportional magnitude would be decreased as the size of the vessel was increased, so that the large ship in a gale would merely encounter waves of the same proportional size as a ship of half the dimensions in half a gale; and it should be remarked, that the largest ships which had beed proposed were only double the lineal dimensions of existing vessels.

As to the impact of waves upon ships, it should be remembered, that a vessel riding on a wave became, virtually, a part of that wave, and moved along with it, as the mass of water, displaced by its bulk, had previously moved. The large Atlantic waves observed by Dr. Scoresby did not strike the ship, but made her rise and fall in a gentle oscillation, each of which lasted 16 seconds, a period of too long duration to admit of any approximation to violent collision between bodies.

It was only the small wind waves, or crests, which moved at a different velocity from that of the ship; and the proposed vessels were so much higher out of the water than the observed altitude of these waves, that the decks would probably never be more than wetted by the spray.

It was explained, that H. M. ship *Rattler* had been assumed as a type, or good example of locomotive efficiency, because the formula $\frac{(v \sqrt{}^3 D^{\frac{2}{3}})}{\text{indicated HP.}}$ gave the highest result of any steamer examined by that rule. It would be seen, that formula merely embraced the relations of velocity, displacement, and working power.

It was stated, that vessel which, from any fault of construction, or from imperfect steering power, was liable to fall into the trough of the sea, would, in that position, be liable to fearful accidents; and instances were cited of two vessels, of 800 tons and 1200 tons respectively, being struck by waves which had carried away all the upper works and swept the decks clear. These practical facts were given to show that the gentle oscillation of heavy waves must be received with some qualification. In answer to this, it was explained that, in a storm there were generally two sets of waves, the long low oscillating wave, and the smaller waves, which were much shorter, rising under the action of the wind. It was these short waves which struck the smaller vessels with so much force when they got on the crest of a large one, but the deck of a very large ship would be too high for such wind waves to break upon it except as spray.

Returns were presented of the performances of a number of paddle-wheel ocean steamers for a period of twenty-two years, tending to prove how greatly the velocity had been increased. This was shown to have arisen from the augmented size and better build of the vessels, with greater power of engines and other engineering improvements. These tables showed the necessity of a careful selection of the period from which a mean average of velocity was deduced; for example, the *Hugh Lindsay*, H. E. I. Co's. steamer, gave, in 1830, a mean average of $5\frac{1}{2}$ knots per hour; whereas, the best of the Cunard and of the Collins' lines of steamers gave a mean average of $12\frac{1}{2}$ knots per hour for the last three years.

It was explained that the average of 7·9 knots per hour had been derived from Admiralty returns, extending from 1848 to 1851, which were the only reliable documents of the kind hitherto published.—Members were urged to supply the present evident want of information on this subject.

As to the question of measurement for tonnage, after discussing the present method, describing that proposed by the parliamentary committee,

and those by the practical men who had been consulted, the system indicated by the author of the paper was examined with care, and was admitted to possess novel features worthy of consideration, in fixing a legal standard of measurement. It was, however, contended that, for scientific purposes, the displacement to the load line was required, and for fiscal purposes it was submitted, that the light and other dues would be more equitably imposed by an *ad valorem* duty on the cargo, rather than on the bulk or form of the vessel.

In winding up the discussion, the dimensions were given of a great raft ship called the *Baron of Renfrew*, which was built at Quebec in the year 1825, by the late Mr. Charles Wood, of Port Glasgow. Her extreme length was 304 feet, extreme breadth 61 feet, clear depth 34 feet, registered tonnage 5294½ tons, and cargo of timber 8500 tons. The draft of water, at the end of the voyage, when water logged, was 31 feet. She had four masts, and the sails of a 36 gun frigate. Her greatest inclination, under press of sail, was about 20 degrees. Her greatest speed, before she became water logged, but with 19 feet of water in the hold, was 8½ knots, which was reduced to 6 knots when she was quite full of water. She made the passage from Quebec to the Isle of Wight in 48 days. It was due to Mr. Charles Wood to mention this daring innovation at so early a period.

It appeared, that if the dimensions of vessels had been increased, it was evident that there had not been any increase of danger, nor was any to be anticipated. The hesitation in receiving new propositions of startling projects was very natural, and, therefore, their discussion was valuable and really useful in eliciting opinions which might otherwise probably not have been given. The feasibility of the Britannia Bridge had been quite as much doubted as that of very large iron ships, and yet it had been executed, and the result was before the world. It appeared evident that, in future, engineers must look even further forward than they had done, and, in their maritime constructions, must adopt dimensions for their docks and harbors to accommodate the increased sizes of the vessels they were destined to receive, but which some years since would have been deemed visionary.

For the Journal of the Franklin Institute.

The Mineral Contents of the Lower Magnesian Limestone of the Upper Mississippi. Condensed from Dr. Owen's Geological Survey of Wisconsin, &c. By Dr. L. Turnbull.

(Continued from page 133.)

The lower magnesian limestone, north of the Wisconsin River, has many points of analogy with the upper magnesian limestone of the Mineral Point and Dubuque districts of Wisconsin and Iowa—a rock, which has proved itself to be extraordinarily productive in lead ore, and has afforded copper ore of excellent quality, which is now smelted with profit in the vicinity of the mines, according to Dr. Owen. This lower magnesian limestone may be considered more favorably situated than the upper, as a mineral-bearing rock. It is considered an established

fact in geology, that, all other things being equal, the lower or older a rock is, the more likely it is to be metalliferous, because nearer rocks of igneous origin.

There can now be little doubt that the whole mining region of the Mineral Point and Dubuque districts of Wisconsin and Iowa is based upon a syenitic and granitic platform, which will be reached by penetrating to the depth of from two to four thousand feet. This is considered as highly favorable to the metalliferous character. The following are actual discoveries in corroboration of these facts:

Near the base of a bluff on the West side of the Mississippi River, some ten or fifteen miles above the mouth of Turkey River, and just above the French Village, from seven to ten thousand pounds of lead ore were obtained from openings in the rock. More or less galena is found here, in all the horizontal openings, for the distance of half a mile to a mile.

Near the mouth of the Kickapoo, on the South-east quarter of Section 10, Township 7, North Range 5, West of the 4th Principal Meridian, pieces of lead ore, weighing from half to three-quarters of a pound, have been obtained from cherty beds of the inferior part of the lower magnesian limestone. A company has lately commenced exploring there, and has obtained some hundred pounds of galena.

On the opposite side of the same valley, Hearn and Ward obtained about four hundred pounds of galena; some masses weighed fifteen pounds. Also, on Section 15, Township 7, North Range 5, West of the 4th Principal Meridian, lead ore has been found; also, in the hills at the first great Western bend of the Kickapoo, below the mouth of Plum Creek, half a mile South of the afore-mentioned valley, Burns and Miller procured about one hundred pounds of lead ore.

East of the 1st Locality, Hearn and Miller dug sixty feet, and followed an East and West lode, in which they obtained a small quantity of lead ore.

All these discoveries were made in the lower magnesian limestone. F. 2.

In the same vicinity, on the South half of Sections 33, 34 and 35, Township 8, North Range 5, West, there are vestiges of ancient diggings, wrought by the aborigines. Also, between Yellow River and the upper Iowa River, eight or ten miles below the Big Spring, lead ore was also discovered.

On the Wazi-oju, W. B. C. Macy, of Dr. Owen's Geological Corps, saw a vein of lead ore, of four inches in width, bearing nearly East and West, and ranging, apparently for the distance of one-half to three-quarters of a mile, through the lower magnesian limestone; also along Plum and Pine Creeks, tributaries of the Kickapoo.

A heavy lode of lead ore is said also to have been discovered on the Half Breed tract, near the Wazi-oju, by Joseph Bison. This vein is represented as being from ten inches to a foot wide, and filled with galena, embedded in the usual matrix of red tenacious clay. Also, two miles below Bad Axe River, lead ore was found attached to calcarious spar, having fallen from the cliff of the lower magnesian limestone.

In the Winnebago Reserve, not far from the Iowa River, and a few

miles North-west of the small town of Lansing, lead ore was found, in small quantities, chiefly in pockets and cavities.

The above instances abundantly prove that the lower magnesian limestone, as well as the upper, is lead-bearing; whether productively so or not, cannot be fully determined until the rock is scientifically mined. It is certain, that at many of the above localities, the rock is exceedingly cherty, and is, consequently, hard, and difficult and expensive to work, and near the surface the ore is much scattered and disseminated through the rock, rather in horizontal openings than in vertical veins; still, if this surface ore should be connected with deeper lodes, as there is some reason to believe it may be, then these would be well worthy the attention of the miner. Under present circumstances, however, and with the uncertainty attaching to the last hypothesis, Dr. Owen did not consider it his duty to recommend lead mineral reservations where this formation prevails.

Dr. Owen estimated the annual produce from the lead mines of the Mineral Point and Dubuque districts, for the year 1839, was thirty millions of pounds. The following are the total shipments for the years 1841 to 1850, inclusive, from his work, and the three additional years being added, make it complete to 1854:—

Shipments of Lead from Galena and Dubuque, and all other points of the Upper Mississippi, for the years 1841, '42, '43, '44, '45, '46, '47, '48, '49, '50, '51, '52 *and* '53.

	Pigs of lead. 1841.	Pigs of lead. 1842.	Pigs of lead. 1843.	Pigs of lead. 1844.	Pigs of lead. 1845.	Pigs of lead. 1846.	Pigs of lead. 1847.	Pigs of lead. 1848.	Pigs of lead. 1849.	Pigs of lead. 1850.	Pigs of lead. 1851.	Pigs of lead. 1852.	Pigs of lead. 1853.
Total.	452,814	447,850	561,321	624,601	778,460	730,714	771,679	680,245	628,934	569,521	474,165	391,582	425,835

As a pig of lead will weigh, on an average, seventy pounds, it appears from the above table, that the annual produce has varied, in the last ten years, from nearly thirty-one millions to upwards of fifty-four millions of pounds.

The decrease in the production of 1848, 1849 and 1850 is, in part, attributable to the number of volunteers in the Mexican war, and in part to emigration to the gold mines of California.

"During the greater part of the season of 1852, extreme low water has been a serious interruption to navigation. The delay and difficulty experienced between Dubuque and St. Louis have been so great that the ruling prices of freight have had the effect to keep back many thousands of pigs that would, under other circumstances, have been carried out. Again, the river virtually closed three weeks earlier than in 1851. In 1851, the last shipment was made on December 3d, and this year, though a much larger quantity was piled up on the levee than usual for the season, the last sent forward was on November 16—a difference of three weeks, covering a period when the lead trade is ordinarily the most active.

Immediately preceding the close of navigation, the roads between this point and the country furnaces were so nearly impassable that but little was received at the various places of shipment. The early closing of the river, the low water during the whole season, and the bad roads, will account for the apparent falling off in the amount produced in 1852 when compared with the shipments of 1851. The deficit shown by the

figures is 82,583 pigs. This, without the explanation we have given, might prove a discouraging item."—*Gal. Jeffersonian.*

The true cause of the great decrease has been the result of the tariff of 1846. Since it begun to take effect, the quantity of lead has steadily declined, until it has become even less than that in 1842. (L. T.)

Iron Ore in the Carboniferous Limestone and Coal Measure of Iowa.—Not far from Dam No. 26, and near the line between Sections 10 and 11, Township 77 North, Range 22 West, there are, probably, one or more beds of coal. Within three or four feet of the top of the shale, *i. e*, at a height of forty or forty-five feet from the Des Moines River, there is, at this locality, a band of ironstone having a specific gravity of 3·45, associated with some sulphuret of zinc, the joints being coated with a crust of selicate of alumina.

The following analysis, by the humid method, gives as follows:—

Bituminous or carbonaceous matter,	01·0
Insoluble earthy matter,	07·6
Carbonate of the protoxide of iron,	65·0
Carbonate of lime,	07·2
Carbonate of magnesia,	10·0
Alumina,	01·8
Peroxide of iron,	04·8
Phosphate of iron,	02·6
	100·0

After pounding and sifting the raw ore, a quantity weighing 1225 grains was roasted and exposed to a red heat in a shallow vessel; after roasting it weighed 865 grains; loss by roasting 360 grains, being equal to 29·4 per cent.

The color, after roasting, was a purple-brown. An assay was then made, in a black lead crucible, at a high temperature, with the following ingredients in the proportion of

Roasted ore,	865 grains.
Bottle glass,	865 "
Chalk,	865 "
Charcoal,	134 "

There resulted therefrom a button of light gray iron, weighing 377 grains, equal to 43·5 per cent. of the roasted ore, and 31 per cent. of the raw ore, differing only 2.5 per cent. from the per centage of metallic iron by the humid method. It appears from the above analysis, that this ironstone is very analogous in its composition to the ore known in Scotland as "Mushet's Black Band," the chief difference being a smaller per centage of carbonaceous matter, and the substitution of phosphorus for sulphur. It is more than probable that a repetition of the analysis of the "Scotch Black Band" would give, also, a small per centage of phosphorus, since Dr. Owen only succeeded in detecting and estimating this element in the Des Moines ore by methods which have been introduced into analytical chemistry within the last few years.

The existence of phosphorus in this ore is not a matter of merely scientific interest, but of practical importance also. Collier and Rinman assert that the "cold-short" property of iron (that is, its liability to become brittle when cold,) is due to the presence of the phosphoret;

while Mushet, whose knowledge of iron and its properties is, probably, superior to that of any other writer, doubts the assertion.

It has, he says, been matter of common remark, that iron of the most perfect quality, as the Swedish, gives out, in working, a strong phosphoric smell; and he adds, that any iron can be made cold-short by introducing into the blast-furnace, through the medium of the flues or otherwise, silica in excess.

In support of this view, he remarks, in his work on iron and steel—"The flue cinder of the balling furnace, which on an average contains thirty per cent. of silica, and the flue furnace cinder of the puddling furnace contains forty per cent., while sand bottoms were in use, furnished striking illustrations of that fact. At first, when these cinders, containing from forty to fifty-two per cent. of iron, were returned to be smelted for the production of forge pigs, the brittleness of the iron was so much increased that fears were entertained as to the practicability of their use, and maintaining a marketable quality of iron. The change of system which took place, from puddling on sand to puddling on iron bottoms, by introducing a less quantity of silica into the blast furnace, had a great tendency to reduce this evil, and restore fibre to the bar-iron."

And he concludes by saying—"From this fact being so clearly ascertained, we obtain a clue to explain the probable cause of cold-short in iron generally, by attributing it to a predominant quantity of silica in the ore, rather than to the existence of phosphorus."

Here is a marked difference between the opinion of so experienced a man as Mushet and the statement of Renman, made in the summer of 1849, to the British Association, at their annual meeting: the statement, namely, that in every instance in which Swedish iron has proved cold-short, he had been able to detect the presence of phosphorus. To this important subject Dr. Owen invites the attention of American chemists and iron masters. It is only by careful chemical analysis, conducted after the most approved method, that this moot point can be finally determined. Should phosphorus invariably be found in cold-short iron, while it should prove to be uniformly absent in iron free from that defect, the inference will be a fair one, that phosphorus is the producing cause.

To be Continued.

For the Journal of the Franklin Institute.

United States Steamers.

The year 1853 has proved a very disastrous one to our Steam Navy; one steamer, the *Alleghany*, in her first engagement with the enemy (wind and tide and fair weather) was completely disabled, after an expenditure of $150,000 for repairs and alterations, and has since been condemned as unfit for service. Another, the *Princeton*, after having been in the hands of the machinists for two years, was finally put in commission last spring, and after several feeble efforts, succeeded in reaching the fishing banks, stopping at several ports by the way, and furnishing the daily press with a variety of articles, as to her unfitness for service, &c. After an absence of a few weeks, she returned, and has again been put in the hands of the doctors; but this time a change has been made in the practice, and

there is some hope for the better, although but little can be expected where the patient has suffered so badly from malpractice. The *San Jacinto* has returned from a foreign station with a bad name, and one engine broken, and her machinery (boilers excepted); has been condemned and removed from the ship, and a contract has been made by the Secretary of the Navy with Merrick & Sons, of this City, for new engines, the terms of the contract being that they are to furnish their own plans and to guarantee the work, and as security that they will fulfil their contract they are not to receive any money on account of contract, until the machinery is approved and accepted by the Department, when one-half of the contract price is to be paid, and at the end of six months' successful steaming the balance, any defects within that time to be made good by the contractors. In departing from the usage of the Department, the Secretary has made a bold stand for the right, and if I am not mistaken, the results will show that *good* machinery can be furnished and warranted at very much less than has usually been paid for a bad article. The following report made to Congress on the subject will be of interest to the readers of the Journal. FULTON.

—

Letter from the Secretary of the Navy, transmitting Report of a Board of Engineers as to the causes of failure of certain steamers of the United States Navy.

December 21, 1853.—Ordered to be printed.

NAV. DEPART., *Dec.* 19, 1853.

SIR: Agreeably to your verbal request, I have the honor to transmit herewith copies of the instructions to, and reports of, the officers ordered to examine into the causes of the recent failures of the Alleghany, Princeton, and San Jacinto.

I am, very respectfully, your obedient servant,

J. C. DOBBIN.

HON. THOMAS S. BOCOCK,
Chair. of Comm. on Naval Affairs, House of Rep.

NAV. DEPART., *Oct.* 27, 1853.

SIR: I have appointed a board of engineers to make certain examinations of the machinery of the Alleghany.

Having confidence in your judgment and skill as a naval constructor, the department desires you to examine the hull of the ship, and report—

1st. Whether, in your judgment, she will answer for a war steamer.

2d. If any weakness or inefficiency of the hull could, in your judgment, have been the cause of the recent disaster to the machinery.

You will report your views to the department.

It is desirable that you should be present when the board of engineers visit the ship, and give them such information touching the hull as they may wish.

I am, respectfully, your obedient servant,

J. C. DOBBIN,

JOHN LENTHALL, Esq.,
Chf. Nav. Constr., Bureau of Construction, Equipment, and Repair.

WASHINGTON, *Oct.* 28, 1853.

SIR: In compliance with your order of yesterday, I have examined the hull of the "Alleghany."

Upon the subject of your first inquiry, I would respectfully state that the hull of a ship of war similar to the "Alleghany," if built of timber in the usual manner, would weigh about 638 tons. From an examination of the bills for the original construction of this vessel, I find there were 334 tons of iron charged for the hull. A portion of this was removed during the last repair at Norfolk; but as additional iron timbers were put below the berth-deck, for a length of forty-five feet amidships, the weight of the materials of the hull will remain nearly the same—that is, it is only about one-half that of a similar ship-of-war built of timber. In general terms, the strength may be taken in proportion to the weight of materials; and that this ship is weak, may be shown by the number of timbers that were broken during her first cruise, and the additional iron braces with which it was necessary to secure her. The short timbers that were put in at Norfolk have added very little to her strength. The shape of this ship is such as has in all other cases been found to cause much strain and uneasiness of motion. This, together with the great deficiency in the quantity of materials, and consequently of strength, in my view, renders her unfit for a war steamer; nor do I consider her form as advantageously adapted to a steam propeller.

Upon the subject of the second inquiry, I would state that I do not consider that the recent disaster to the machinery should be attributed to the weakness of the hull, for that has been pointed out since the 5th of July, 1850, as stated in an official report of that date.

All ships are subject to a change of shape in their rolling and pitching motions, and engineers avoid connecting any of the delicate moving parts of their machinery with them, as it would cause the engines to work their own destruction. But in this ship, when the great mass of machinery, the magnitude of the parts, and the manner in which they are connected together, are taken into consideration, it is a matter of surprise that its enormous power has not shaken so frail a hull to pieces, which in a rough sea might have been the result.

I have the honor to be, sir, with the highest respect,

Your obedient servant,

JOHN LENTHALL.

Hon. J. C. DOBBIN, *Sec'y. of the Nav.*

NAV. DEPART., *Oct.* 27, 1853.

GENTLEMEN: Public attention has been attracted to the unfortunate failures which have recently occurred in the several steamers of the navy. The inefficiency of the Princeton, the Alleghany, and the San Jacinto, particularly after the expenditure of large amounts of money, renders it the duty of the department to institute searching investigation, not only as to the causes of those repeated disasters, but as to the officers or individuals who are responsible. The service suffers in reputation; money is expended liberally, producing results only requiring further

outlay; the interests of the government are subjected to inconvenience, and perhaps hazard.

Having confidence in your judgment, skill, and integrity, the department desires you to report, after due examination—

1. The causes of the failure of the San Jacinto, the Princeton, and the Allegbany.
2. Who advised or designed the machinery for them.
3. Whether the boilers in the Princeton and Alleghany are upon a different principle from those in our war steamers which are doing well.
4. Whether that plan of boilers had been ever before tried in this country, and at whose instance they were introduced or modified.

The records of the department can be examined, if desired, to facilitate your investigations.

I am, respectfully, your obedient servant,

J. C. DOBBIN.

DANIEL B. MARTIN, Esq., *Eng. in Chf., U. S. N.*
HENRY HUNT, Esq., *Chf. Eng., U. S. N.*
CHARLES W. COPELAND, Esq.

P. S.—You will, in your report, state whether the Lamb & Summer boiler was adopted for the Princeton and Alleghany, and why; also the reason for its alteration to the present form of boiler.

J. C. D.

WASHINGTON, *Oct.* 28, 1853.

SIR: We have the honor to acknowledge the receipt of your order of the 27th instant, and, in compliance with one portion thereof, we have visited the steamer Alleghany—yesterday, and again to day—for the purpose of examining the engines and boilers, and would respectfully submit the following brief preliminary report upon that vessel:

Without, at this time, entering into details, and the reasons why, but reserving that for a future report, we would simply state—

1st. The engine frames are badly broken, and they cannot be repaired and the engines properly modified, without taking a large portion of them out of the vessel, and incurring considerable expense and loss of time.

2d. The boilers are quite inadequate to supplying the engines with the requisite amount of steam.

3d. The hull of the vessel has not sufficient strength for engines of so great power.

4th. In our opinion, the model of the vessel is entirely unsuited to the application of the screw propeller.

We would, therefore, respectfully recommend that no more money be expended upon that vessel to fit her for the purpose of a naval steamer.

We remain, very respectfully, &c.,

DANL. B. MARTIN, *Eng. in Chf.*
H. HUNT, *Chf. Eng.*
CHAS. W. COPELAND.

Hon. J. C. DOBBIN, *Sec'y. of the Nav.*

WASHINGTON, *Nov.* 19, 1853.

SIR: As a final report in reply to your letter of the 27th ultimo, (a preliminary one having been already presented,) we have the honor to submit the following:

To your first inquiry, viz: "The causes of the failure of the San Jacinto, the Princeton, and the Alleghany."

In regard to the San Jacinto, we conceive the principal causes to be—

1st. A very improper, injudicious, and in every way inferior arrangement of the engines for the purposes of their application, both in its general plans and details. In the general plan, the great defect was such arrangement as that almost the whole power of the forward engine was transferred from one end only of the cross-head: as the result, the breaking of the piston rod has occurred. Another objectionable feature is, that they are very unequally balanced, thereby involving very great irregularity in their motion.

The whole arrangement of the details was very complicated, which is highly objectionable in engines which are to run at a high velocity. The arrangement of details was also defective, in that it was almost impossible to adjust any part when in operation; also, that in case of necessity to make repairs, it involved the taking apart of much of the engines.

Many parts of the engines are badly proportioned, the frames particularly being shown, from the time engines were first put in operation, to be entirely too light.

There is also an objectionable feature in the location of the propeller on one side of the centre line of the ship, requiring a constant counteraction of the rudder, and causing the vessel to work badly when under sail.

The boilers we believe to have operated well in every respect, with the exception of some leaks in the centre boiler, the consequence of an injury received when landing on the wharf at New York.

In regard to the Princeton:

The principal cause of the failure of this vessel we conceive to be in the plan and arrangement of the boilers, the consumption of fuel being very great in proportion to the result obtained.

As to the engines, we are of the opinion that the substituting a "Sickel's cut-off," as then arranged, in a very complicated manner, with a puppet valve, for the original slide valve cut-off, to have been a very injudicious alteration to these engines; in fact, all the important alterations of the engines from the original arrangement have been highly injudicious.

The propeller is not such as we would approve, but yet we have no doubt its operation would have been comparatively satisfactory had the engines and boilers been efficient.

In regard to the Alleghany:

With respect to the boilers, the same defects exist as in those of the Princeton, with the additional one of their being quite too small to supply the requisite steam to the engines.

The arrangement of the engines we think too complicated, and not sufficient provision is made for adjustment and attendance. We are also of the opinion that the workmanship and arrangement of details are quite inferior, and that the engines are not erected in the ship in a proper and substantial manner; on the contrary, they reflect discredit upon all who had to do with their design, arrangement, or construction.

The breaking of the frames has resulted from two causes, viz: the weakness of the ship, and the want of a proper foundation under them. We also think the designer of the engine frames censurable for not providing, in the design and strength of the frames, for the *known* weakness of the ship's bottom, and the want of a proper foundation. We consider the ship entirely unsuited for the purposes of a naval steamer, both in strength and model. That the hull is very weak, may be determined by simple inspection; but more than this, it had already been proved most satisfactorily to be the case, by experience, previous to placing the present engines on board. Although the ship was strengthened, as recommended by Mr. Stuart, late engineer in chief, it was done in such a manner as to add in no degree to the strength of the bottom.

The model we also believe to be of the most objectionable form that could be devised for the application of the screw propeller, or for the carrying of an armament; and we are confident in the opinion, that, had the operation of the engines and boilers been all that could be desired, no satisfactory speed would have been attained by the vessel. And we can only express our utter astonishment that so great expense should ever have been recommended upon *such* a hull for a war steamer, or that, when recommended, it should have been approved.

In reply to the second question, viz: "Who advised or designed the machinery for them?"

First. Of the "San Jacinto," we find by reference to records in the Navy Department, that, so far as relates to the location of the propeller, shaft, and rudder, relatively, these points were decided upon by a board convened March 23, 1847, for the purpose of fixing upon dimensions, power, and general arrangements of four steamers, which had been authorized by an act of Congress. Therefore, so far as these points may have affected the efficiency of the vessel, this board is responsible.

We conceive that they are also responsible in having adopted a general plan of engines submitted by Mr. Haswell and Mr. Faron; but as the original plan has been destroyed, we cannot say that the plan upon which they were *actually* constructed was the same—in fact, there is strong evidence to the contrary.

It also appears by the record, that this board approved of double puppet valves being used, and also decided upon the use of the "Sickels" cut-off; the same being advocated by the engineers whose general plan of engines was adopted. It also appears by the record, that Mr. Haswell, the former engineer in chief, in conjunction with Mr. Faron, presented and advocated the plan of engine which was approved by the board. The plan was strongly opposed by Mr. Copeland during the first day it was before the board; but, on the second day, he appears to have withdrawn his objections, and it was adopted.

From all the information we have gathered, we feel justified in saying

that the engines as executed, both in their general plan and details, were either the work of Mr. Haswell or approved by him. This is not only admitted, but *claimed* by Mr. H., in many of his letters up to the time when it became evident that many difficulties would be encountered and the result unsatisfactory. Indeed, this is placed beyond dispute, up to November, 1850; as, in a letter from Mr. Stuart to the bureau, of June 21st, 1851, he asserts that Mr. Haswell claims them distinctly as "original with him," and the "children of his own brain."

Under date of January 20, 1849, he (Mr. H.) says: "The San Jacinto is to have a screw propeller, the *design* for the construction of which, however, is *not yet made.*" Also, by a report of his to the bureau, dated September 28, 1849, he says: "Of the engines, (San Jacinto's,) they were designed in this office, and in their arrangements the rights of no individual have been invaded."

Immediately upon Charles B. Stuart, Esq., being appointed engineer in chief, his attention appears to have been called to the difficulties and apprehensions in regard to these engines; as he, under the date of December 31, 1850, reports these apprehensions to the bureau, and requests that a board of engineers may be ordered to examine and report upon the state of matters. A board was appointed, composed of Messrs. Williamson, Sewell, and Hunt. These gentlemen reported only upon the propeller and rudder, recommending a modification of the same, to overcome certain difficulties. These recommendations of the board were, without doubt, judicious at that time. No alterations to engines were suggested; indeed, they were probably too far advanced, at this time, to permit an alteration that would prove effective.

As to the Princeton:

Originally all the plans of the Princeton, together with the Lamb & Summer boilers, were presented and recommended by Mr. Stuart, engineer in chief. After the failure of the boilers, it appears that a board was ordered to examine and report what alteration should be made. This board were Messrs. Williamson, Sewell, Isherwood, and Ellis. They examined, and reported in favor of making a double tier of furnaces and a horizontal division of the flues, but no other alteration in the plan of the flues was recommended.

The opinion of the board was adopted in regard to the furnaces, and, by the recommendation of Messrs. Murray and Hazlehurst, and of Mr. Isherwood, as appears by his letter claiming it, the further alteration was made of substituting tubes for the Lamb & Summer flues. This entire alteration, though not rendering the boilers as efficient as was anticipated, was a very great improvement upon the previous arrangement. We have, therefore, no hesitation in saying, that whoever may have suggested the plan and arrangement of the whole previous to the alteration of the boilers, Mr. Stuart is the responsible party; as, in a letter dated July 22, 1851, he says, expressly, that the plans for the alterations of the Alleghany and Princeton are so far approved by him as to prevent any delay in their completion.

In reference to the "Alleghany:" This vessel was altered to a screw propeller at the suggestion of Mr. Stuart. All that we have already stated in regard to the Lamb & Summer boilers in the "Princeton" being

recommended by Mr. Stuart, is also substantially true of this vessel, although we find by some of the correspondence that the credit of the design is claimed by Mr. Isherwood.

It is also clear, by his own letter, that the alterations of this vessel were approved by Mr. Stuart. It appears, however, that the carrying out of the alterations was mainly intrusted to Mr. Isherwood, as we find frequently orders for Mr. I. to instruct Mr. Williamson, the engineer in charge, in regard to the execution of the work. We deem it proper to state that on both the "Princeton" and "Alleghany," although the responsibility is expressly assumed by Mr. Stuart, it appears very clear, from the drawings and record, that the preparing all the plans and directing the execution of the work was placed in the hands of Mr. Isherwood, and that he visited the works of the contractors for that purpose from time to time, by order of the Bureau of Construction.

In answer to the third inquiry, viz: "Whether the boilers in the 'Princeton' and 'Alleghany' are upon a different principle from those in our war steamers which are doing well?"—

We would reply, that the original "Lamb & Summer" boilers were unlike any boilers previously used in this country, though introduced very successfully into steamers in England; and we have no reason to doubt of their success in these vessels, had not the approved arrangement and proportions adopted by Messrs. Lamb & Summer been departed from in a very extraordinary degree.

As now altered, they are still different in their arrangements from any other boilers that we are acquainted with, although the principle of their construction is similar to that of many other boilers in use.

Query fourth, of your letter, is already fully answered in the foregoing part of this report.

With respect to the Lamb & Summer boilers, as noticed in the postscript to your letter, we would observe that, from the best information we can obtain, they were adopted for the "Princeton" and "Alleghany" upon the recommendation of Mr. Stuart, former engineer in chief, and Mr. Isherwood. *Why* they recommended them we cannot say, other than what appears upon the record; which they state to be, that they would weigh less and occupy less room, and be more efficient than ordinary flue boilers.

We find also that a patent fee of 45 cents per superficial foot of heating surface of these boilers was paid to J. J. Greenough, Esq., attorney for the patentees; and we further find, in reference to the records of the Patent Office, that the patent was taken out in this country by William Sewell, Jr., late a chief engineer in the navy.

Having thus, as we believe, replied fully to all the queries propounded in your letter of the 27th ultimo, the same is hereby respectfully submitted.

Your obedient servants,

DANIEL B. MARTIN, *Eng. in Chf.*
H. HUNT, *Chf. Eng.*
CHAS. W. COPELAND.

Hon. JAMES C. DOBBIN, *Sec'y. of the Nav.*

For the Journal of the Franklin Institute.

Proportions of Locomotive Boilers. By Zerah Colburn.

I propose to discuss, in this paper, some of the proportions of the greatest influence in the production of steam in locomotive boilers. I shall endeavor to do so in the plainest manner, so that my deductions, if they should be founded on a correct conception, may be available to the operative as well as the theorist.

The objects sought in the construction of any boiler, of a given size and weight, are the generation and economical absorption of the greatest amount of heat. The first of these operations is made in the furnace; the second in both the furnace and tubes.

As the ordinary *form* of locomotive boiler is found to be of the most efficiency in these operations, I shall discuss, as I have already said, only the *proportions* of the locomotive boiler, and shall suggest no essentially different form or mode of construction.

The requisites for a boiler furnace are capacity for fuel, admission of air, water contact, escape of gases, and provision, of course, for firing. The first involves the amount and relation of length, width, and depth of furnace; the second, the gross area and air-opening of grate; the third, the "water spaces" around furnace; the fourth, the openings into tubes, and the last is had by the door.

The capacity and relative dimensions of furnace, grate area, air opening, and tube opening are the principal fire-box details which are influential in the generation of heat. All of these dimensions are deducible more from experiment than from theoretical inquiry. In discussing their extent and mutual relation, however, there are considerations which, if allowed for, will determine many of the general principles upon which they are based.

The capacity of furnace must be such as to contain, without choking the ends of the tubes, sufficient fuel for the necessary rate of combustion, and without the necessity of constant firing. The grate air-opening must admit sufficient air for the given rate of combustion, and as this air is expanded to six or seven-fold volume before leaving the furnace, the exit openings must be of ample dimensions.

The capacity of furnace is governed materially by the amount of carbon, proportionate to the whole amount, in bulk, of fuel burnt. Coke is nearly all carbon; wood contains but a small proportion, say from one-fourth to one-third. As carbon is the true heating element, the capacity of furnaces should be, other things being equal, inversely as the quantity of carbon in a given bulk of fuel.

Again, the admission of air is distributed over nearly the entire bottom of the furnace. The escape of air is made from but one end of the furnace.

The transition from these general principles is easy. The capacity of the furnace has been increased, in modern locomotives, more by an increase of length than of either of its other dimensions. This was done because the space between the driving wheels was limited, and that a portion of this space was required for the framing and springs of the

engine. For a gauge of 4 feet 8½ inches, the distance between the driving wheels, transversely across the engine, is 4 feet 5½ inches. Many engines have been built, where the width of frame and springs would give a grate of but 35 inches width, while in other cases, by a different arrangement of framing, this width has been made 44 inches.

Now, I wish to maintain the general principle, that *width* of furnace is more influential in producing rapid combustion than *length*. The reasons may be briefly stated as these:—The air passes through the fuel for the distance in which the latter lies in the furnace. A number of diagonal lines might be drawn from the centre of tube openings to successive points in the length of the grate, which will essentially represent the general distance traversed. From the fact, however, that the surface of the fuel generally inclines towards the tubes, *increase* of distance is greater with each successive horizontal approach to the back side of the furnace. Often, too, the grate inclines *from* the fire, by which the difference of distance is rendered still greater, according as the entrance of air is made towards the back side of the furnace.

Now, in proportion to the distance traversed is the superficial resistance of the fuel to the passage of air increased. It must be, at least, in this proportion, while the impact or "momentum" of the air would be of some more advantage with a thin fire than with a deep one. Again, were the distance traversed among the fuel, by the air, the same, the effect of the draft would be exhibited more strongly upon those contents of the furnace *nearest* the source of the action of the draft. And the ascent of air, answering to the demands of the draft at the tube mouths, would *supplant* the air, so to speak, that might otherwise enter the tubes from the rear of the furnace.

From these combined circumstances the intensity of the draft is inversely to the distance of the place of entrance from the place of escape of the air, but not in the same ratio. It may not be an unfair estimate to consider the intensity of the draft diminished three-fourths when the distance traversed by the air is doubled by horizontal removal of the place of air admission from the tube sheet.

It is in consequence of the greater intensity of the draft at the forward end of the grate that, to prevent the insulation of the lower part of the tube sheet by unheated air, the "dead plate" is used to exclude the air at that point. The "dead plate" is merely a closed bottom of the furnace, or "blank grate," and is now much used to promote economy of fuel in wood-burning engines, while it is claimed as an essential feature of Mr. Milholland's coal-burning boiler.

The "dead plate," however, robs the grate, as the space above this plate receives no direct supply of air; serving for no other purpose than to hold an amount of fuel which would be just as well held by an increase of the depth of the furnace. Now, as that portion of the furnace above the mouths of the bottom tubes cannot be filled with fuel without liability of "choking" the mouths of the tubes, whereby the production of carbonic oxide is caused, much of the heat is wasted, and the steam pressure falls below the working point, it would appear that there could be no loss of room available for fuel, or of the useful capacity of the furnace, by projecting the tube sheet inwards and towards the door. It would

add a little, say $10 worth of labor, to the expense of making the boiler, but it would, doubtless, save that trifling sum in a short time, by a more economical consumption of fuel. The supply of air would be increased by permitting the use of the entire area of grate, while the passage of unheated air would be *from* and not *upon* the front sheet; and, what is of nearly equal importance, the contents of the back portion of the furnace would be brought nearer the action of the draft. With a projecting tube sheet there would be less liability of covering the mouths of the tubes.

There is another important object to be secured by widening the furnace to the greatest limits allowed by a common gauge. With a boiler of the largest size which can be got between the wheels, and such as are becoming general standards for heavy express engines, it becomes necessary to increase the width of fire-box above the frame, to obtain room for a sufficient number of tubes. The water spaces, for the same reason, are made as thin as possible, and the ascent of steam is, therefore, retarded, the tendency being to diminish rather than increase the width of water space towards the top of the furnace. Under the combined contraction of the water spaces, and their curved, instead of straight, upward direction, they do not prove as serviceable as they should in the production of steam, and they do not so fully prevent overheating. The width of the water spaces, next to that of the furnace, is among the most important dimensions of the boiler.

In proportion as width is substituted for length of furnace, the ash pan may be diminished in depth, and room obtained for some increase of depth of furnace. The damper, also, becomes more sensitive to the admission of air, and can be regulated with more economy in its operation on the draft.

The relation of length to width in some of our modern wood-burning locomotive furnaces is as $1\frac{1}{2}$ to 1. With many of Stephenson's earlier engines, the proportion was as about $\frac{1}{2}$ to 1.

Keeping in view the requisite of mixing the greatest quantity of carbon and oxygen, in a given time, and with a given weight and size of boiler, we must remember, that while the former element is supplied by *hand*, the latter is only supplied by means which impose, at the best, a sensible load upon the working of the engine. Inasmuch, however, as a natural admission and escape of air is maintained, is this resistance reduced. If we find that the resistance to the admission of air is reduced by substituting width for length of grate, by so much, we may know, will be reduced the power of draft necessary to overcome this resistance, or, with a given draft, by so much will combustion, otherwise evaporation, or otherwise *power*, be increased.

The next important element in the proportions of the furnace is the opening of the tube mouths, or of the thimbles which tighten them in their places. From an internal diameter of 2 inches this opening has been reduced to $1\frac{1}{8}$ inch, the former size being that allowed in Stephenson's early engines, and the latter having been adopted in some of the heaviest engines built by Rogers, Ketchum & Grosvenor. This contraction attends the reduction in the diameter of the tubes, made for the purpose of obtaining greater heating surface, and is partly due to the increased thickness of thimbles of cast iron, as compared with wrought

iron, or as, in earlier times, none at all. If the greatest extent of absorbent surface was not an object with a given size of boiler, it would be better if the opening for the escape of heated air were in one large flue.

The processes of combustion and of evaporation are, in some respects, alike; and it is believed that the resemblance may be recognised sufficiently to perceive the importance of rapid draft. In combustion, the elements are carbon and oxygen; in evaporation, commonly speaking, the elements are heat and water. In each case, one of the elements is a palpable physical substance, the other an invisible gas. The want of either wood or water would, of course, suspend one or both of the operations. If steam is rapidly worked from a boiler, the rate of evaporation is increased. If the steam pipe be throttled, however, the pressure will rise but slowly, and the rate of evaporation will be diminished. Now, the comparison in the process of combustion is this:—If the carbon of the fuel be thoroughly and rapidly oxydized, or, what is the same, if the *products* of combustion were rapidly carried off, whether imparted to the water or wasted, and room be as quickly made for more, a larger *amount* of heat would be generated. If the tube openings, however, by their undue contraction, throttled the draft, the presence of the products of combustion within the furnace would retard the oxydation of more carbon. In the case of evaporation, the accumulated pressure of steam above the water level would be a mechanical obstacle to further production, while in combustion the accumulated products would exert a chemical preventive to further oxydation.

Especially is an increase of diameter of tubes required where these, from any cause, are extended to an unusual length. The friction surface being increased by lengthening the tube, as well as increasing the amount of air to be forced out, or the back pressure, the tube should be enlarged in diameter, to take up sufficient heated air to insure a rapid draft.

With any ordinary contraction tubes, it is possible to get a sufficiently rapid rate of combustion by narrowing the blast pipes; but this imposes a direct load upon the working of the engine.

The effect of contracted tubes may be readily inferred. Rapid evaporation can be had only by a rapid communication of heat to all parts of the water. The small tube, under an ordinary draft, takes up a quantity of heat which becomes quickly absorbed, to an extent that reduces the escaping gases to a temperature below any heating efficiency. The result is the same as if a large portion of the "heating surface" were taken away. Sufficient heat does not reach the forward portion of the tube surface to impart any elevation of temperature to the water already under the action of the first portion of the tubes. The forward ends of the tubes are, therefore, of little value, and might nearly as well be dispensed with; while, simply, by furnishing the required heat, they could be readily brought into effective use. To supply an abundance of steam of a high pressure, a great amount of heat must necessarily be applied, and some heat must be wasted; but, in proportion to the intensity of the fire in the furnace, the less is the *relative* loss. Hence, small grates, under a good draft, are most economical in their consumption of fuel. The available or useful heating quality of any temperature is the difference between it and that of the object to be heated; and this is the reason

why there is greater economy in a rapid draft and intense fire. To maintain such fires, however, without injuring the boiler, either thin iron of the best quality must be used, or else the best description of copper. The water spaces must also be wide, and the sheets incline outwards from the space on each side in approaching the top.

It is not unworthy of the subject to compare the early engines, built by Stephenson and other cotemporary builders, with those of the present day. Besides the great difference in the relative proportions of furnaces, already noticed, the tube opening was one-fifth of the entire grate area, where it is now from but one-tenth to one-fifteenth. The tubes were three and a-half times the length of the furnace, while now the distance is from two and a-half to three times. The little boilers of former times were notorious for their steaming powers. For a given capacity of cylinder, it is true that they had slightly more boiler capacity and heating surface than is now given, but they had the countervailing disadvantage of the want of expansive gear. Many of our present heavy express engines, with nearly an equal proportion of heating surface to a given capacity of cylinder, are, with the most perfect expansive apparatus, well known to be short of steam.

The practical means of widening the furnace, within certain limits, are the use of the thin edge frame on the sides of the fire-box, and such suspension of the springs as will not interfere between the wheels and furnace. The spring of the back driving axle will, probably, require to be hung transversely across the engine; with which arrangement, the equalizing levers can be kept much as at present. The trailing wheels of English engines have their springs hung across the engine, to permit of the use of the thin frame. I look upon 43 inches as the greatest width of furnace attainable within the narrow gauge and with inside framing.

To obtain greater width of tube opening, the best means are in the use of iron tubes, of the best quality, and the entire omission of thimbles. The coal engines built by Winans and by Baldwin, having tubes and furnaces entirely of iron, furnished in Philadelphia, are found to stand the severe action of anthracite, and when well set give no trouble in respect to caking. The coal-burning engines built by Winans have 2½ inch tubes for 14 feet length.

Another means of improving the working of locomotive boilers, is in forming a better connexion of the tubes and chimney than is afforded by the ordinary "smoke box." The direction of this passage must be eased, and its contents reduced to the smallest practicable extent. The use to which the upper part of the smoke box is generally placed, has prevented the separation of that part from the general contents of this chamber. The steam pipes and throttle box, for the want of a better situation, have been placed here, and often in such a manner as to stand in the way of the draft. A plan, which I proposed some time since, for the relief of the draft of engines, on a line having low bridges, which plan, I have lately learned, was tried, with good results, some years since, on the Columbia road, but for some reason was not continued in use, was to place a level sheet of iron across the smoke box, just above the upper row of tubes. This would reduce the contents of the smoke box, and, conse-

quently, the amount of air to be lifted out. It would allow of extending the chimney downwards, and of thereby increasing its effective length, and, also, of lowering the blast pipes, and substituting blast pressure for blast suction. I look to this plan as one likely to become generally applied.

For the Journal of the Franklin Institute.

Particulars of the Steamer Tennessee.

Baltimore.—Hull built by John A. Robb, Baltimore. Machinery by Charles Reeder, Jun., Baltimore. Intended service, Baltimore and Charleston.

HULL.—

Length on deck,	210 feet.
Breadth of beam at midship section,	33 " 11 inches.
Depth of hold,	19 "
Length of engine and boiler space,	55 "
Floor timbers at throats, moulded,	13½ "
" " sided,	8 "
Distance of frames apart at centres,	26 "
Coal Bunkers—Iron.	
Capacity of coal bunkers in tons of coal,	150.
Masts and rig—Two masts, foremast square rigged.	
Tonnage,	1149.

ENGINE—One—Vertical beam.

Diameter of cylinder,	72 inches.
Length of stroke,	9 feet.
Weight of engine,	238,200 pounds.

BOILERS—Two, double return flued.

Length of boilers,	18 feet.
Breadth "	11 " 6 inches.
Height " exclusive of steam chimney,	12 "
Number of furnaces,	3 in each.
Length of grate bars,	6 " 4 "
Grate surface,	123 sq. ft.
Fire "	3570 "
Number of flues,	18.
Internal diameter of flues,	18 and 30 inches.
Length of tubes,	8 and 13½ feet.
Diameter of smoke pipe,	72 inches.
Height "	32 feet.
Weight of boiler *without water*,	93,800 pounds.
Description of coal,	Anthracite.

WATER WHEELS.—

Diameter of water wheel,	28 feet.
Length of blades,	9 "
Depth "	26 inches.
Number "	24.

Remarks.—Solid floor; 13 inches centre, side and bilge keelsons; iron lattice braced; square fastened throughout, and coppered; one 6-inch independent fire pump, and one 5-inch injection pump.

For the Journal of the Franklin Institute.

Particulars of the Steamer Nashville.

New York.—Hull built by William Collyer, New York. Machinery by Novelty Works, New York. Owners, Spofford, Tileston & Co. Intended service, New York to Charleston.

HULL.—

Length on deck,	216 feet.
Breadth of beam at midship section,	34 " 8 inches.
Depths of hold,	22 "
Length of engine and boiler space,	64 " 6 "
Capacity of coal bunkers in tons of coal,	185 tons.
Draft of water at load line,	12 feet.
Floor timbers, moulded,	14½ inches.
" sided,	14½ "
Distance of frames apart at centres,	29 "
Masts and rig,	Foretopsail Schooner.
Tonnage,	1235

ENGINE.—One—Side lever.

Diameter of cylinder,	86 inches.
Length of stroke,	8 feet.
Maximum pressure of steam in pounds,	28
Maximum revolutions per minute,	19

BOILERS.—Two—Miller's patent return flued.

Length of boilers,	24 feet.
Breadth "	12 " 3 inches.
Height " exclusive of steam chimney.	12 " 3 "
Number of furnaces in each boiler (3 above, 2 below),	5
Length of grate bars,	7 " 2 "
Number of flues,	33
Internal diameter of return flues,	10, 11, 13, and 15 inches.
Diameter of smoke pipe,	6 feet 4 "
Height of smoke pipe,	38 "
Draft of furnaces, natural.	
Fire surface in each boiler,	2274 "
Description of coal,	Anthracite.

WATER WHEELS.

Diameter of water wheel,	32 feet.
Length of blades,	10 "
Depth "	20 inches.
Number "	28

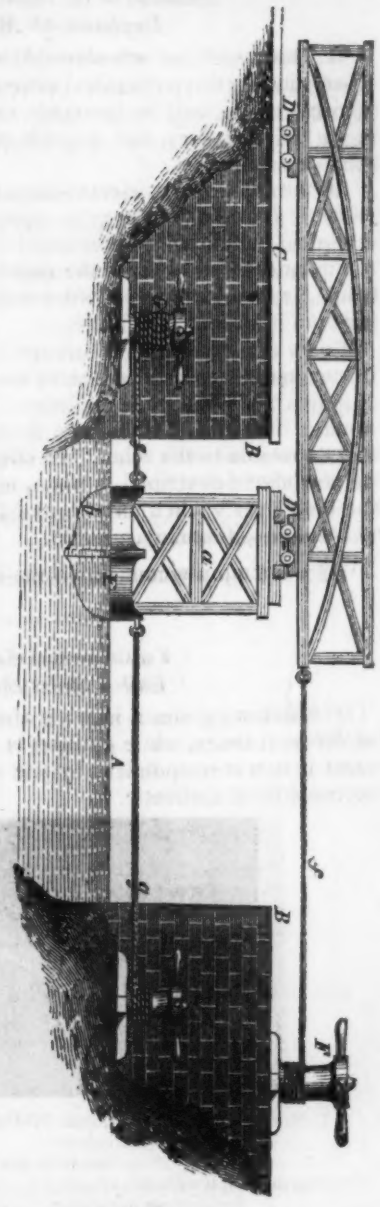
Remarks.—Floors filled in solid. Blowers to ventilate fire-rooms.

Champion's Mode of Building and Transporting Bridges. (Patent antedated May 22, 1853.

This engraving is a side view or elevation of Thomas and Sumuel Champion's improved mode of building bridges on the land, and conveying them to their places over streams.

The cardinal feature in this mode is, the building of the bridge on the land, at about the level with its intended position, on a prepared roadway C, on one of the previously prepared abutments B B, on which

the trucks, D D, are placed for the land part of the transportation. Which having been accomplished, a vessel or vessels E, of sufficient buoyancy for the burden to be imposed, having upon it a frame work, A, of proper height, is floated by the stream A, either under the already projecting end of the bridge, or against the abutment, for the purpose of having the bridge rolled upon it. The vessel being provided with a valve to receive, and a pump to discharge water, it may be ballasted therewith, and its buoyancy regulated as desired; after which, all things being in readiness, by means of the capstans, F G, with the ropes, *f g*, attached, the vessel and bridge upon it may be speedily and safely drawn over its place, and lowered to its proper position, by letting water into the vessel, or by jack-screws or other process.



It is claimed for this mode, that a great saving is effected thereby, over the old mode of timber supports from the bed of the stream, even where such supports are practicable, but where the streams are deep, the currents rapid, and the bridge high above the water, such supports are always dangerous, liable to be carried away with freshets, and in some cases positively impracticable.

It is further claimed that the advantages are equally in favor of this mode, over that adopted in placing the celebrated Britannia Tubular Bridge over the Menai Straits, as it is nearly, if not quite as convenient and safe to build the bridge at once at the right as at any other height, while it is much easier and safer to move the whole affair on a level, or inclined properly prepared road and flotilla, than to raise the whole weight by any process perpendicularly to its place.

By this mode all the danger incident to working over the water, all the cost and danger of raising such heavy structures from the water, is avoided, by means as simple and safe as they are beautifully effective.

Translated for the Journal of the Franklin Institute.

Explosion of Mines at a distance.

M. Dumoncel has conceived the idea, which we think a happy one, of substituting the mechanical action of electric currents, in place of their physical action; and he has made an apparatus of very little cost, working at all distances, and capable of acting on an unlimited number of mines at a time.

Let us suppose an electro-magnet of fine wire, fixed in one of the walls of a little oaken box; the spring armature carrying a detent button: a vertical match-holder is secured to a spring strongly bent by this button; along the path which the match will describe when the spring unbends, is sprinkled fine powder communicating with a fuse which transmits the ignition to the mine.

Every thing being thus arranged, the current is established; the electro-magnet attracts its armature; the spring escapes; the match rubs and is ignited, and the mine explodes. If it is required to explode a certain number of mines at a distance from each other, the current passes from one apparatus to the other. To effect this, M. Dumoncel adds to the apparatus above described, a plate, against which the spring which carries the match rests when unbent, and this is made to close a second circuit, and so on.—*Cosmos*, iv, p. 29.

Why not simply connect all the electro-magnets in one circuit?—Ed.

For the Journal of the Franklin Institute.

United States Steamer Powhattan.

The following steam logs are abstracts of the performance of this ship, at different times, while cruising in the China Seas. They were communicated to a correspondent by one of the engineers of the ship, and may be considered authentic. Com. Pub.

U. S. Steamer Powhattan, date, 26 Feb., at 3·20 P. M.

Mean pressure indicated,	13·56
" " due to initial pressure and expansion,	14·22

Port engine, lower ends of cylinder.

Revolutions per minute,	9
Pressure of steam,	11

Throttle valve open.

Vacuum per gauge,	26½
Temperature of hot well,	102°

Moderate wind ahead with considerable sea.

PERFORMANCE UNDER STEAM ASSISTED BY SAIL.

Date. 1853.	No. of consecutive hours.	Speed of vessel in ft. per hr. in knots of 6120 feet.	Course of the vessel.	WIND. Direction.	WIND. Kind.	Sail.	Sea.	ENGINE. Immersion of lower edge of paddles in feet and inches.	ENGINE. Steam pressure per square inch in lbs. above atmosphere.	ENGINE. Double strokes of piston per minute.	ENGINE. Steam cut off at from com. of stroke.	ENGINE. Back press. in condenser per gauge.	ENGINE. Proportion of throttle open.	BOILERS. Number of furnaces in operation.	BOILERS. Pounds of coal consumed per hour.	BOILERS. Kind of coal.	Speed of the vessel in feet per hour.	Speed of the centre of pressure of the paddles in feet per hour.	Oblique action of the paddles.	Slip of the centre of pressure of the paddles in feet per hour.
Feb. 20, 21,	23	9·25	East.	Abeam.	Mod. to fresh.	Sing. rfd. topsail.	Mod. to rogh. abm.	6 9	9·4	10·75	42	2½	8	Ten.	2997	Cumberland and bituminous.	56·616	60·114	25·96	5·82
Mar. 8, 9,	14	7·67	SW by W	N. E.	Gentle.	Do.	Moderate.	7 3	7·6	8·76	45	2½	8	Eight.	1891	Newcastle and Welsh.	46·940	48·895	27·94	4·
Jun. 8 to 11.	90	9·2	N. E.	On quarter.	Moderat	To' gallant sails.	Do.	5 4	9·75	12·2	40	2½	8	Ten.	3285	Anthracite and bituminous.	56·204	68·259	20·18	17·2
Jul. 19, 20.	23	9·6	N W by N ½ N.	Do.	Do.	Fore & aft.	Do.	6 4	11·15	11·3	40	2½	8	Ten.	3721	Lebanon and bituminous.	58·752	63·170	23·38	7.
Performance under Sail, Steam acting as Auxiliary.																				
April 29 to May 1,	50	10·2	E'd. and S'd.	N'd. and W'd.	To'-gal't. breeze.	To'-gal'nt. sails.	Mod. aft.	6 5	9·56	11·35	31	2½	8	Eight.	2745	Anthracite and bituminous.	62·424	63·427	23·6	1·58
Aug 6 to 9.	84	7 9	E. N. E.	S'd. and W'd.	Gentle.	Do.	Moderate to smooth.	7 3	10·7	9·35	32 8	2½	7	Seven.	2323	Do.	48·348	52·173		·7
Performance under Steam unassisted by Sail.																				
Mar. 24 to April 1,	204	8·4	S. S. E.	Ahead.	Gent. to smooth.	None.	Moderate.	6 3	9·2	11·17	58	2½	8	Ten.	3586	Welsh and Newcastle.	51·408	62·424	23·0	17·64
Ap 5 to 12,	192	8·41	SSE½E.	Do.	Moderat	Do.	Do.	5 10¼	11·5	11·5	56·5	2½	8	Twelve.	3633	Newcastle.	51·469	64·239	21·5	19·87
May 2 to 4,	72	8·42	E. ¾ S.	On bow.	Fresh.	Do.	Heavy.	5 11	11·2	10·8	50	2½	8	Ten.	3657	Anthracite and Cumberland.	51·530	60·330	21·67	14·58
" 8 to 10,	49	10·1	E. N. E.	N. E.	Gentle.	Do.	Smooth.	5 0	11·33	14·33	45	2½	8	10 for 11 hs.. and 12 for 38 hours.	3824	Do.	61·812	80·176	18 15	22·9
"28 to 30,	72	7·93	E. N. E.	Nd & Ed.	Moderat	Do.	Rough.	6 9	11·07	9·78	55	2½	8	Twelve.	3607	Anthracite.	48·53'	54·531	25·96	11·0
Performance under Sail alone, with Paddles removed.																				
March 14,	24	3·58	S'd. and E'd.	N. E.	Light trades.	All draw'g sail set.	Smooth.													
" 18 to 22.	120	5·1	"	Do.	do.	do.	do.													

For the Journal of the Franklin Institute.

Naval Steamers.

Having observed, recently, in several of the public papers, articles extolling the virtues of the U. S. Steamers *Susquehanna* and *Powhattan*, now belonging to the Japan Squadron, and knowing that the reports published were not a fair statement of facts, but were furnished for publication by interested parties, I have thought it worth the trouble to obtain the following facts, so that each may have that credit which is justly their due. The Japan Squadron of steamers consists of the *Mississippi*, of 1800 tons, *Susquehanna*, 2400 tons, and *Powhattan*, 2400 tons; the former has been in commission since 1841; the latter are now on their first cruise. Their total cost, at the time of their first cruise, has been as follows:—

Mississippi,	$569,670 =	$316·48	per ton.
Susquehanna,	743,044 =	309·60	"
Powhattan,	788,160 =	328·40	"

The machinery for each one cost—

Mississippi,	$243,784 =	$135·44	per ton.
Susquehanna,	332,766 =	138·65	"
Powhattan,	389,980 =	162·45	"

From this table it will be seen that while the *Mississippi* was built at an early period, (her side lever engines being the first, of any magnitude, made in this country,) when heavy forgings and castings cost much more per pound than at present; yet her *solid* side lever engines cost but a trifle more per ton than the inclined engines of the *Susquehanna*, and much less than those of the *Powhattan*, although the latter form of engine has been claimed to be the best, by those who wish to extol the new at the expense of the old. A few facts will show which is the most to be relied on. The *Mississippi*, up to the latest dates from her, had on this cruise steamed nearly 30,000 miles, and was then in perfect order for service, and at no time since leaving Norfolk had she been out of order, but at all times was ready to go when wanted. The *Susquehanna* has had a series of small mishaps, and at present has two air pump beams cracked, (which have been secured) and will have to be furnished with a new centre shaft before she returns home (which has been sent to her). The *Powhattan* required 10 weeks after she arrived out at China, before she was reported for duty. My object has been to show that our first steamer has been the most efficient; that her machinery, which was well made, has stood the test of time, and been well tried on nearly all our naval stations, and that to-day she is what she always has been, the *most reliable steamer* in the Navy. FULTON.

Translated for the Journal of the Franklin Institute.

Description of the Interferential Refractometer of Arago.

If two beams of white light, proceeding from the same source, are propagated through the same homogeneous medium, and have followed paths which are very nearly equal, they form, wherever they cross each

other at a slight angle, a compound system of dark and light fringes, easily visible. The central fringe is the least colored; it is nearly either white or black, white between two blacks, or black between two whites, and this character is sufficient for its recognition. In the place which it occupies, the interfering rays have passed over exactly equal distances. Everything, intensity and color are symmetrical on each side of this central fringe. M. Arago determined, many years ago, that the relations of the paths described did not alone determine the place of the fringes thus formed by the interference of the two beams of light. By placing in the air, an exceedingly thin strip of glass, in the path of one of the beams, he found the bands incline towards the slip. This experiment, repeated a great number of times, with all kinds of solids, liquids, and gases, leads to a law which connects, in a very simple manner, the displacement of the fringes with the refracting power and thickness of the transparent body which is thus traversed by one only of the two beams.

So soon as he had discovered this entirely new mode of measuring the refractive powers of transparent bodies, M. Arago was led to apply it to the study of this power in moist air. It was, in fact, very important to know certainly whether the hygrometer was to be taken into consideration, in the calculation of astronomical refractions; it is a question already treated by two illustrious physicists; first, by La Place, by the aid of the general supposition that vapors, and the liquid from which they come, have the same refracting powers,—a supposition very plausible, on the hypothesis of emission, but not confirmed by subsequent researches; afterwards by Biot, by experiments as accurate as the method used admitted of. Fresnel joined Arago in performing the experiment, which he had desired, and the following is the way in which it was tried: two tubes of thin copper, of about a metre in length, were soldered together, like the two barrels of a double-barrelled gun; at each extremity these two tubes were closed by the same plate of glass, with parallel faces. Stop cocks admitted the substances to be experimented on. When the tubes held air of the same density, temperature, and dryness, the beam which traversed the right hand tube, produced, by mixing, as it came out, with that coming from the left, colored fringes, whose place coincided almost exactly with that of the fringes resulting from the reaction of these same beams propagated through free air.

If, while the elastic force in the two tubes remained equal, one contained chloride of calcium and the other water, the tubes being then filled, one with air completely dry, the other with air saturated with moisture, the bands formed by the interference of the beams traversing each a metre of air in the two tubes, no longer occupied the same place as in free air; the interposition of the tubes caused a notable displacement equal to the breadth of one and a half fringes; this displacement was always toward the side of the dry air.

The direction of the displacement proved, in the first place, incontestibly, that dry air had more refracting power than moist air; the ratio remained to be determined. From the law which we explained above, or from experiments made on the reduction of the pressure necessary in one of the tubes, in order that the fringes should be displaced by a fringe and a half toward the opposite side, the ratio of the refractive power of the two

airs might be directly determined. But it was possible that a slight coating of moisture might have been deposited on the internal surface of the two glasses in the damp tube; now, such a deposit, however thin, might be supposed to play an important part in the phenomena, and would mask a great part of the effect looked for. This was the difficulty which deterred Fresnel from giving any numbers in support of the conclusion which he and M. Arago drew from their joint experiment.

This difficulty M. Arago has since entirely removed, by repeating the former experiment by means of two other tubes, the one dry, the other moist, closed at their extremities by the same glasses which had been used before; but this time they were but one centimetre, in place of a metre, in length. The influence of the difference of the refracting power of the two airs being thus almost eliminated, nothing was left but the effect of the film of moisture, precipitated on the interior surface of the two glass plates in the moist tube; this effect was always inappreciable. The displacement, therefore, of a fringe and a half observed in the tubes one metre in length, depended exclusively on the comparative refracting powers of dry air, and air saturated with moisture. The difference at 25° Cent. (77° F.,) was such that if we assume as the ratio of the sine of the angle of incidence to that of refraction, when light passes from a vacuum into dry air, the number 1·0002945. This ratio, when the light passes from vacuum into moist air, (saturated,) becomes 1·0002936. A difference in the seventh decimal place of the indices of refraction is thus shown in experiments in which the ray has been refracted. Let us add, that, as the exactness of the method is proportional to the length of the tubes, nothing prevents us from going much further with it.

This experiment will be completed by another. It is required to know whether heat exercises upon the refractive power of air any influence except that due to its power of dilatation. The doubt merits examination the more, since warm glass refracts more than cold glass. In order to leave nothing undetermined in a question of such importance as that of astronomical refractions, it remains still to study the influence of electricity at rest or in motion. All this is now accessible, and will soon be cleared up.

We will briefly indicate some other applications of which the method of M. Arago is susceptible, and which he has explained to the Academy. Let us conceive of a tube of a certain length, void of air, closed at its two extremities by plates of glass and hermetically sealed. By selecting properly these two pieces of glass, and a third movable plate, intended to be placed in the path of the external ray, we may cause the interference-fringes of the rays passing through the air and vacuum to be formed, by an effect of compensation, exactly as though they had passed through a homogeneous medium. Only, if the external atmosphere changes its refracting power, the fringes will be displaced, their movement being toward the tube when the refractive power diminishes, and the reverse when it increases. Such an instrument might then be employed in observatories, in place of the barometer and thermometer, for the determination of the respective power of the atmosphere. The observation might be made at the height of the object glass of the instru-

ment, and would put an end to the interminable disputes as to the use of the external or internal thermometer in calculating refractions.

The refracting power of air is a function of its pressure and temperature; the pressure remaining constant, if the temperature varies a single degree Centigrade (1·8° Fah.); the fringes in an instrument 11 decimetres (43 inches) long, would be displaced by the breadth of ten entire fringes. This movement may be measured to the tenth of a fringe-breadth.

The instrument described may, therefore, when combined with a barometer, serve to determine the temperature to 0·05° Cent.

This extreme sensibility may be indefinitely increased by increasing the length of the vacuum tube; but this is one of the least advantages of the method. A thermometer, being under the influence of the radiation of the sky, of the ground, and of all surrounding objects, never gives the temperature of the air. On the contrary, the result deduced from a property of the atmosphere, which is a function of its temperature, is completely protected from all these causes of error.

On journeys, if one was contented to take the atmospheric temperatures such as they are now determined by the thermometer, the vacuum tube might serve as a barometer. A length of tube of one metre (39·4 inches) would permit the appreciation of variations of pressure of from 0·1 to 0·2 of a millimetre (0·0039 to 0·0078 inch). A barometer without a liquid would appear singular enough, but travellers would, especially, remark its small fragility.

M. Arago has shown that his method for determining refractions may be used to determine the state of the atmospheres at all distances from bodies, whether heated or not; to follow the interesting experiments of Faraday upon the atmospheres of mercurial vapors, and their diminution of density as the distance from the liquid increases; perhaps even with tubes sufficiently long, to make sensible the influence of odors. The quickness of the observation permits us, moreover, to conceive the hope that by giving the tube a proper direction in reference to an energetic centre of sound, several properties of sonorous waves may be made sensible to the eye.

As to liquids, it results from observations already made, that by the observation of fringes we may detect, even near the maximum of density, changes of refraction in water corresponding to 0·025° Cent. Who does not see here a new and very precise method of studying the propagation of heat in this kind of bodies, without breaking their continuity by introducing into them the bulb and stem of the thermometer. The same remark applies to the study of the propagation of heat through transparent solids.

Finally, even the increase of the refractive power of water and glass, resulting from the compressibility of these substances, may be detected by the aid of these new instruments. With a tube a metre in length, the compressibility of water for each 0·02 of an atmosphere will be visible; on a tube of glass, of the same length, 0·01 of an atmosphere will become sensible.

This interferential barometer and thermometer would be susceptible of great improvement if we could solve a difficult problem, of which the distinguished physicists, MM. Arago and Babinet, have not yet suc-

ceeded in finding a solution. It is required to bring two luminous rays, separated several centimetres, to conditions of useful interference, without many preceding trials.

In a following number we will give the drawing, description and theory of the instrument as constructed by M. Soleil. We will also add the result of some experiments made under the direction of M. Arago, by MM. Laugier, Soleil and Duboscq, on the refracting form of fog compared with that of pure air.—*Cosmos*, vol. iv, p. 8.

Translated for the Journal of the Franklin Institute.

Veritès Electro-Magnetic Safety Apparatus for Railway Trains.

In a preceding number of the Journal we gave a description of an electric clock, by M. Veritè, of Beauvais, extracted from the Parisian journal, *Cosmos*. From the same journal, for 6th January, we take a notice of another invention, by the same author, for the purpose of guarding against accidents to railway trains, much resembling in its principle the safety switch of Mr. MacRea, described at page 138 of this volume.

"We will suppose, for the sake of fixing our ideas, that it is required to regulate the running of the trains on the Northern Railroad from Paris to Amiens. At each end are placed two connected dials, supported on a small pillar of wood or cast iron, one of them facing Paris, the other Amiens, so placed as to be easily seen by the engine drivers when they arrive at the station. Each of them carries a plainly visible needle, and their circumference is divided into as many parts as there are kilometres* between the two consecutive stations at which they are placed. Each of these spaces is numbered, beginning with this at the upper part of the dial, which is 0.

Let us suppose that a train leaves the Northern Depot, and that the first station is at St. Denis, distant from Paris 8 kilom. The dial at Paris will be divided into eight equal parts, and, at the departure of the train, the needle will be vertical, its point showing 0. When the train has run 1 kilometre the needle will pass from 0 to 1; it will pass to 2 when the train has run 2 kilometres, and so on; so that, if the train arrives at St. Denis without interruption, the needle will have described the whole circumference, and will have returned to 0, ready for the departure of the next train. The first locomotive, on reaching St. Denis, will come into communication with a second dial, (whose index is also at 0,) divided into as many parts as there are kilometres between St. Denis and Enghien, the second station. The train, in its progress, will operate on the dial at St. Denis as it operated on that at Paris, and when it has reached Enghien, the index at St. Denis will have returned to 0. And this operation will take place from station to station, until the train reaches the extremity of the line.

In this way the progress of the train may be followed from station to station, kilometre by kilometre. If any accident should happen, or any

* The Kilometre is the French unit of distance, corresponding to our mile. Its length is about 0·62 of a statute mile.

delay in the train, notice will be immediately given by the movement of the hand on the dial; the needle stopping at the same time as the train, will show by the number to which it points, the distance at which the accident has happened.

In general, the service of the most crowded lines does not require that the trains should be running at the same time between any two stations. In fact, the distance between no two stations is more than 20 kilometres at most, which the locomotive runs over in less than 25 minutes. To suppose that two trains are at any time between the same two stations, is to admit that the trains are running within 25 minutes of each other; but the interests of the passengers, whose safety should be secured as far as possible, as well as the interests of the company, which must take care of their stock, demand, it seems to us, that the trains should not run closer than this.

As then the conductors of the trains will see, immediately on their arrival at any station, where the train ahead of them is, and as they will not quit that station until the needle of the dial, by its return to 0, shows that the first train has reached the next station, it will be absolutely impossible for the second train to run into the one before it.

In exceptional cases, where trains have to run more closely than this, and where, in consequence, two trains may be between the same stations, it will be easy to establish one or two systems of connected dials between the stations.

We will now explain the method devised by M. Veritè to secure the motion of the index on the dials.

Behind each dial is a wheel, with a number of teeth equal to the number of kilometres between the two stations; this wheel is governed by an escapement, which allows one tooth to pass every time that it is moved. The escapement is put in motion by the attraction of an electro-magnet, operated on by a current, which is closed by the locomotive itself, every time that it has run 1 kilometre.

One of the poles of the battery is put into communication with a wire, hung like our ordinary telegraph wires, upon posts, along the track. At every kilometre a branch of this wire is taken down and terminates by an inclined plane near the rail; the other pole communicates with the ground, or, still better, with one of the rails of the track. The locomotive or tender is also supplied with a movable piece of metal, terminating in an inclined plane, and so placed as necessarily to meet as it passes the inclined planes in which the conducting wires terminate. Thus, with whatever speed it may be running, at arriving at the end of the kilometre, the locomotive will always close the circuit; the closed circuit will magnetize the wire, which will work the escapement, the escapement will pass one tooth of the wheel, and the index moving forward one number will indicate that the train has made one kilometre more.

If it be required to prevent the much more rare accidents caused by the collision of two trains moving in opposite directions on the same track, special dials may be placed and properly arranged, on which the conductors may read as they pass, the distance which separates them

from the train moving towards them. They will then slack their speed, or take other means to avoid the collision.

M. Veritè has constructed, in his shop at Beauvais, a model, on a small scale, of the apparatus which we have described. This apparatus succeeds so well as to render him almost certain of its success on a large scale. He is now ready to apply it on a line of railroad, as soon as he may be invited to do so by his Excellency, the Minister of Public Works."—*Cosmos*, vol. iv, p. 7.

On many of our crowded roads the principle of this ingenious contrivance would be, doubtless, found of very useful application. It is, as we have said, fundamentally the same as that of Mr. MacRea, which we have already commended to the notice of our readers. In our country the most frequent and the most terrible accidents are those arising from the collision of opposite trains; and here the signal of Mr. MacRea commends itself particularly to the attention of those who desire to travel as well safely as fast.

Translated for the Journal of the Franklin Institute.

Consumption of Fuel in Steam Engines with single and double Cylinders.

M. Farcot, machinist, at Port St. Ouen, has made experiments upon two machines made by him for the plate-glass manufactory of St. Gobin, which may serve as a basis for a rigorous comparison between machines of one and two cylinders. The experiments were made under the direction of M. Laforet, engineer of the glass-works at Chauny. The first machine, with two cylinders, has a nominal power of 30 horse, and makes 28 revolutions per minute. When tried on the 26th October, during 5 hours, at 38 horse-power, under a pressure from 4·75 to 5 atmospheres, it consumed less than 1·15 kil. (2½ lbs.) of common charcoal per horse-power per hour. Afterwards tried at 45 horse-power, it worked with the greatest ease.

The second machine is horizontal, has but one cylinder, working at 42 revolutions per minute, and is also nominally 30 horse-power. Tried for 5 hours on the 28th October, it consumed only 1·106 kil. (2·4 lbs.) per horse-power per hour. Afterwards tried at 49 horse-power, it gave no evidence of injury to any of its running parts. These two machines have now been in regular service for several months, and work usually with a force of from 40 to 45 horse-power.

It has been hitherto admitted, that the double-cylinder machines expended less steam and fuel than those with but one cylinder. The preceding experiments show, that when well constructed, the expenditure is the same in both systems. If it be true theoretically, that the double-cylinder machines work more regularly, it is now certain, that practically, the one-cylinder machines of M. Farcot work with a perfect regularity. Horizontal (*oscillating?*) engines, for instance, drive spinning machinery, and paper works more regularly than the hydraulic motors which they replace, and actually leave nothing to be desired. Their price, for equal force, is less than that of fixed machines, and their velocity is in better adjustment to that of the shafts which they drive.

Our readers will observe the low rate of consumption in these two machines; it is much less than that required for the best engines turning an axis, hitherto known. The arts have therefore realized in this respect, an immense progress of 2 or even 3 kilogrammes (4½ to 6½lbs.) per horse-power per hour. This advance is especially due to the Society for the Encouragement of National Industry, for they have always excited, proved, sanctioned, and recompensed it.—*Cosmos*, iv, p. 41.

Translated for the Journal of the Franklin Institute.

The Cosmoramic Stereoscope of Duboscq.

At the bottom of a rectangular box, 40 inches long, 7 inches wide, and 4 inches high, a couple of stereoscopic images of ⅛th plate upon albuminized glass are fixed; in front of each of these two objects are fixed in the box, two achromatic lenses, whose distance from the plates is greater than their focal length so that the plates are beyond their foci; in the paths of the rays as they leave the lenses and beyond the point at which they cross, are erected systems of plano-convex lenses, like the lenses of a Huyghens eye-piece, and of large diameter; the enlarged images are examined through lenses which again magnify them. The lineal dimensions of the stereoscopic objects are thus magnified twelve times, and their surface one hundred and forty-four times, while the effect of relief is perfectly kept.

The figure annexed will give a still more perfect idea of this apparatus, and of the path of the rays of light. I, I′ are the two stereoscopic plates; L, L′ the two lenses; M, M′, N, N′ the couples of plano-convex lenses; J and J′ the resulting images; L, L′ the magnifying glasses through which they are looked at.

In reality, the cosmoramic stereoscope is, in its essential composition, an ordinary microscope, whose magnifying lens is an object glass of long focus, and whose field-lenses have a large diameter.

Cosmos, vol. iv, p. 33.

For the Journal of the Franklin Institute.

The Ericsson

Has at last made a short trial trip, having reached Staten Island, a distance of seven miles from New York, when her pistons were found to leak so badly, that she was taken back to her old berth, at the works of

Messrs. Hogg & Delamater. Her engines attained a speed of six and a half revolutions per minute during the trial. Report says, that the present engines are to come out and a pair of enlarged size (between the present and those first used) are to be put in. If this is true, what may we not expect from the credulity of the age.

For the Journal of the Franklin Institute.

The U. S. Naval Steamer, Princeton

After having her machinery refitted (taking out Sickel's cut-off valve,) has recently made a trial trip of three days at sea, when her engines and boilers were found to operate to the satisfaction of the engineers on board, and she is now reported ready for duty.

Notice of Steam Ship Himalaya, the largest Steamer in the World.

The English have just built the iron screw steamer Himalaya, belonging to the Peninsular and Oriental Steam Navigation Company.

The *Himalaya* is the largest ocean steam-ship in the world. She is 3550 tons register, equal to over 4000 tons burthen, and is of the extraordinary length of 372 feet 9 inches. The length of the keel is 311 feet; breadth for tonnage, 46 feet 2 inches; depth of hold, 24 feet 9 inches. These proportions, when contrasted with the dimensions of other ships, give a great advantage, particularly in length, to the *Himalaya;* for example, the *Duke of Wellington*, of 131 guns, although of greater beam and depth, is inferior in length by ninety-two feet to the *Himalaya.* The screw steamer *Great Britain* is 332 feet long, or forty feet shorter than the *Himalaya;* while the American clipper ship *Great Republic*, recently destroyed by fire in New York, was only 325 feet long, or of forty-seven feet less length than the *Himalaya.* Although the *Himalaya* exceeds in so large a degree the length of the *Duke of Wellington*, yet she is inferior in tonnage to that ship, the *Duke* being $3759\frac{4}{4}$ tons, or about 209 tons larger than the *Himalaya.* The cylinders of the engines are of 84 inches diameter, with a $3\frac{1}{2}$ feet stroke, and the revolutions per minute are from 50 to 60. The screw is a two-bladed one, on the old principle, of 18 feet diameter, with a 28 feet pitch, and weighs nearly seven tons. The vessel is full ship rigged; and the masts, spars, and sails which have been supplied, are those suitable for a clipper sailing ship of 1600 or 1800 tons.

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*Title Deeds in Times of Yore.**

We lately saw, for a moment, the deed of the conveyance of an estate of about 300 acres of land sold by the Earl of Hereford, in 1226, or 627 years ago, the total writing of which measured $5\frac{1}{2}$ inches wide by $2\frac{3}{4}$

* From Herapath's Journal, June, 1853.

deep. His lordship's seal was attached by a ribbon, being a clumsy piece of wood with his arms carved thereon. From the circumstances under which we saw it, we could not read it, but both in dimensions and character, it was a good specimen of the business brevity of olden times.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 16, 1854.

Samuel V. Merrick, President, in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from Lieut. George F. Emmons, U. S. N.; The Massachusetts Charitable Mechanics Institute, Boston, Mass.; The Maryland Institute, Baltimore, Md.; Henry R. Campbell, Esq., Lebanon, N. H.; George H. Hart, Esq., and M. W. Baldwin, Esq., Penn. Legislature; Solomon W. Roberts, Esq., Pittsburg, Penna.; and The Mine Hill and Schuylkill Haven Railroad Co.; Conger Sherman, Esq.; M. B. Smith, Esq.; George M. Conarroe, Esq.; and Prof. John F. Frazer, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of January, 1854.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Science and the Arts, reported the following Memorial, with a recommendation that it be adopted; which was done, and it was ordered to be signed by the officers of the Institute, and forwarded to both Houses of Congress, viz.:

To the Senate and House of Representatives of the United States, in Congress assembled:

The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, respectfully present to your consideration a subject of great practical and social interest, and ask for it such action as its importance warrants.

The government of Great Britain has recently made a partial change in one of the denominations of its coinage, and others are under consideration which will tend, if adopted, to enlarge and perfect the decimal system, which is the basis of the new coin.

A movement of this sort, by a nation so kindred to our own, in its language, institutions, weights, measures and general policy, is viewed

as a highly favorable opportunity for endeavoring to make the coinage of the two countries perfectly identical in weight, value, and fineness, and, in fact, in everything but mere name.

An inspection of any table showing the value and other characteristics of the coins now in use in the two countries, will demonstrate that no very disturbing element would be introduced by thus equalizing the coinage.

While great and important social and commercial advantages would flow from the proposed change, the disadvantages, if any, would be so small as not to affect, sensibly, the relations of contracting parties.

The constant and rapidly-increasing intercourse between the two countries carries the respective coins of each into the other, and they are then either broken up and re-coined, or await the demands of trade for the settlement of accounts, by which they are returned to the points of original issue.

Every re-coinage is attended with considerable expense and some loss, and the process is now repeated so often in the great commercial countries, that it claims the study of every friend of national economy.

While such considerations weigh, to some extent, with every people, they press with peculiar force when applied as between Great Britain and the United States. Practically, the dealings of the two nations with each other and with the rest of the world are settled in their own commercial and financial centres, and hence it follows that the settlement of accounts in an identical coinage would be as simple as is now the computation of yards and pounds.

It is deemed unnecessary to present any special plan of weights, or other details for the accomplishment of the uniformity we are seeking to obtain; such details must be settled by the legislative and treaty-making powers, and to their wisdom they may be safely left.

All that we desire to urge, is, the fact that Great Britain has the subject of its coinage under discussion, with a view to its change, in whole or in part, to a decimal notation, and that an opportunity now exists for treating with her for the desired identification of coins, that may not soon occur again.

It is deemed fitting that those two nations whose language, institutions, and habits, seem destined to almost universal dominion, should unite in a plan which will simplify their monetary dealings, as their other intercourse is already simplified, and thus enable their citizens to do away with the annoyance of computing the fluctuations of the nominal exchanges, and to use the half eagle of the United States, and the sovereign of Great Britain, and all the multiples and sub-multiples of them, as measures of value in either country, without change or calculation, just in the same way that the coins of one pass in its respective states, and of the other in its several counties and territorial divisions.

Our memorial therefore asks that such legislation may be had by your honorable bodies, as will authorize the executive authority of the Union to negotiate with the government of Great Britain on this important subject, and to carry into effect, with the least possible delay, the changes in the coin, that the adoption of uniformity may render necessary.

And your memorialists will ever pray, &c.

New Candidates for membership in the Institute (5), were proposed, and those proposed at the last meeting (3), were duly elected.

The Standing Committees for the ensuing year were nominated by the President, and appointed, as follows:

On the Library.

John Allen,
James H. Cresson,
George Erety,
Raper Hoskins,
William S. Levering,
James Lukens,
John P. Parke,
William A. Rolin,
Clement W. Smith,
Thomas S. Stewart.

On Cabinet of Models.

Samuel S. Ash,
James J. Clark,
Edward P. Eastwick,
William T. Forsyth,
Israel W. Morris, Jr.
F. De B. Richards,
James D. Rice,
Charles J. Shain,
John A. Wimer,
Charles Welsh.

On Exhibitions.

John E. Addicks,
John Agnew,
John C. Cresson,
Geo. W. Conarroe,
Owen Evans,
And. M. Eastwick,
William H. Love,
Algernon S. Roberts,
Isaac S. Williams,
Thos. J. Weygandt.

Cabinet of Minerals and Geological Specimens.

John F. Frazer,
Wm. W. Fleming,
John L. Le Conte,
Angus N. Macpherson,
John S. Powell,
B. Howard Rand,
Percival Roberts,
Lawrence Turnbull,
John C. Trautwine,
Charles M. Wetherill.

On Meetings.

Charles M. Cresson,
Washington Jones,
Daniel L. Leeds,
J. Vaughan Merrick,
B. Howard Rand,
Fairman Rogers,
Algernon Roberts,
George W. Smith,
Lawrence Turnbull,
Charles M. Wetherill.

Cabinet of Arts and Manufactures.

James C. Booth,
Jos. J. Barras,
Samuel M. Bines,
George M. Conarroe,
B. Barton Gumpert,
William Harris,
Wm. H. Hazzard,
J. M. Sommerville,
Thomas J. Weygandt,
Isaac S. Williams.

On Meteorology.

Owen Evans,
John F. Frazer,
L. C. Francis,
Jas. A. Kirkpatrick,
E. Otis Kendall,
A. L. Kennedy,
B. B. McKinley,
James A. Meigs,
Edw. Parrish,
Geo. J. Ziegler.

Dr Rand exhibited to the members a beautiful miniature working model of the line of magnetic telegraph from New York to Washington, made for Prof. Morse, by Mr. James J. Clarke of this City, from designs by George Harding, Esq., although very small, the whole works beautifully, and reflects the highest credit upon those engaged in its design and construction.

Mr. Fairman Rogers called the attention of the meeting to the condition of the work executed, about four years ago, on the line of railroad built to avoid the inclined plane, on the old Columbia railroad, and illustrated it by a drawing of one of the arch-ways. The work referred to, is the sustaining wall and two arched passages, extending from the west abutment of the Market Street Bridge, to the first road bridge, a distance of 400 or 500 feet. The wall was built partly over the excavation of the old canal, and had to be repaired some time after its erection, from the unequal settling of the foundations. The coping of the wall now presents an elegant, undulating line, causing the light iron railing above it to assume twists, certainly never contemplated by the maker. The arch-way nearest the bridge, originally a full centre arch of six feet span, has been disturbed by the pressure upon its haunches, raising the crown so